THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 45. Thursday, October 22, 1931. No. 792.

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial: 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, the Advertisement Manager, or the Publisher of
THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.
Telegraphic Address: "Zacatecas, Rand, London."
Telephone: Temple Bar 3951 (5 lines).

Contents.

	PAGE
Forthcoming Events	249
Purchase Wisely	249
The Recent Conferences	249
Copper Producers in Council	250
I.B.F. Branch-Presidents	250
Random Shots	250
"Migra" Iron, a New Special Pig-Iron for High-Quality Castings	251
The Metallurgist in the Foundry	253
Cast Materials for High-Temperature Service	254
Personal Efficiency in the Foundry	255
Notes on a Research on Faraday's "Steels and Alloys"	258
Educating Foundry Apprentices	258
Hardness Induced by Nitriding	259
I.B.F. Elects New Members	259
Catalogue Received	259
This Week's News in Brief	260
Trade Talk	260
Personal	260
Obituary	260
Reports and Dividends	260
Raw Material Markets	262
Tungsten in China	262
Contracts Open	262
New Companies	262

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT: 1931-32:
A. Harley, The Daimler Company, Limited, Daimler Works, Coventry.

LIST OF SECRETARIES—
General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester. London Office: 49, Wellington Street, London, W.C.2.
Birmingham: F. K. Neath, 24, St. Paul's Square, Birmingham.
Sheffield: T. R. Walker, 33, Ladysmith Avenue, Nether Edge, Sheffield.
Scottish: J. Bell, 60, St. Enoch Square, Glasgow.
Lancashire: J. E. Cooke, 1, Derbyshire Crescent, Stretford, Manchester.
London: H. G. Sommerfield, Charterhouse Chambers, Charterhouse Square, London, E.C.1.
Newcastle-upon-Tyne: J. W. Eckford, 4, Mosley Street, Newcastle-upon-Tyne.
East Midlands: H. Bunting, 82, Otter Street, Derby.
West Riding of Yorkshire Branch: S. W. Wise 110, Pullan Avenue, Eccleshill, Bradford.
Wales and Monmouth Branch: J. J. McClelland, 12, Clifton Place, Stow Hill, Newport, Mon.
Middlesbrough: F. A. Harper, "The Briars," Bishopton Road, Stockton-on-Tees.

Foundry Trades' Equipment and Supplies Association.

President: D. H. Wood,
Titan Works, Charles Henry Street, Birmingham.
Secretary: K. W. Bridges, Grand Buildings, Trafalgar Square, London, W.C.2.

Welsh Engineers' and Founders' Association.

Secretary: E. J. Griffiths, 2, Royal Metal Exchange, Swansea.

BRITISH CAST IRON RESEARCH ASSOCIATION.
The Registered Office and Laboratories of the B.C.I.R.A. are at:—
24, ST. PAUL'S SQUARE, BIRMINGHAM.
Telephone: Central 1868. Telegrams: CIRA.
The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk (*Telephone 332*).

Forthcoming Events.

OCTOBER 23.

Society of Chemical Industry (*Liverpool Section*):—Opening meeting at the University, Liverpool. Address by the chairman, Dr. William Trantom, on "The Barium Industry."

OCTOBER 31.

The Co-ordinating Committee:—Annual dinner and dance at the Queen's Hotel, Birmingham.

NOVEMBER 18-20.

Ceramic Society (*Refractory Materials Section*):—Autumn meeting in London.

Institute of British Foundrymen.

OCTOBER 24.

East Midlands Branch:—Ordinary meeting at Derby. "Cupola Practice," Paper by J. E. Hurst.

Newcastle-upon-Tyne and District Branch:—Visit to Norwood Coke Works of Priestman Collieries, Limited, also Paper on "The Manufacture and Properties of Malleable Castings," by J. K. Smithson.

Wales and Monmouth Branch:—Ordinary meeting at Newport. "Light Casting Problems," Paper by G. Moran.

Purchase Wisely.

In far too many cases purchasing agents or buyers in firms have the power to accept or reject anything which is submitted to them by suppliers of raw materials, equipment, tools and the like. The buyer is usually recruited from the ranks of the clerical staff, and while he may be adept at making a good purchase from a pounds, shillings and pence point of view, he cannot be expected to have such a complete technical knowledge as to be able to discriminate between the qualities of different materials or types of machinery. Unfortunately with a large number of firms it is impossible for a salesman to get past the buyer, to whom he has to explain technical points which are only half understood by his hearer. This information, if passed on at all, is of necessity retailed to the works manager second hand, and must, therefore, lose some of its force in the process.

One of the best methods of dealing with salesmen is that of a firm near London, whose works manager or his assistant sees all representatives. The newer the article, or the more up to date the machinery offered for sale, the better their firm likes it, because they know that, if anything revolutionary is put in the market, it will have been thoroughly investigated by their works manager before it has filtered through the buying departments of other firms. In the case of raw materials, the representative has every opportunity of discussing his firm's products with a man possessing a technically-trained mind, and can obviously make out a far better case for his goods than he could to the layman. If his firm's products be approved, the buyer is instructed to send future inquiries to his firm. Thereafter, the buyer exercises his true function, which is to buy from approved firms as advantageously as possible, compatible with delivery and other specificational requirements.

An important feature to be associated with the partial relegation of the technical aspects of buying to the technical staff is the relief of congestion in waiting rooms. We are convinced that the average buyer wastes more time interviewing salesmen than is warranted. If he is competent at his job, he must leave himself adequate time to study really important market movements, forecasting his employers' requirements, searching for new sources of supply, attending exchanges, and so on. It is also advantageous for the works staff to make greater contact with the outside world by interviewing technical representatives, who, by similar contacts, can convey tendencies in technical developments. The only argument against this method is the management's fear of what Mr. Eric N. Simons has aptly described the "ales" type of salesman—an individual for which the modern executive officer has the most profound contempt.

The Recent Conferences.

The depreciated pound sterling seems likely to make Continental visits for some time to come twenty to forty per cent. dearer than they have been during the past few years, so those who went to the conferences at Zürich and Milan may congratulate themselves—those who got back in time, that is, to save themselves inconvenience. We are not quite sure whether the pound fell away from the gold standard or whether it was pushed, because some people seem anxious to have it back, others are content for it to find its level, whilst others would have us permanently devalue it. Agitation is, in fact, being conducted to make the Government declare that they will prevent it going any higher than 16s. 8d. (*i.e.*, four dollars). This would automatically act as a 20 per cent. tax on much foreign travel.

The Milan Congress was remarkable for the way in which the industry secured the interest of the most powerful forces in the State, as the personal interest of Signor Mussolini and His Holiness the Pope testifies. Naturally the Duce hoped that the opportunities offered for seeing Italy at close quarters would convince foreign visitors that Italy does not groan under a tyrannous yoke of Fascism, as its enemies claim. On the other hand, Fascism appears to have done much for the industrial regeneration of Italy, although that does not imply that the same policy would be equally successful elsewhere. The Exhibition and Congress was altogether very successful, and should prove useful in developing "foundry-consciousness" in Italy.

The Institute of Metals meeting at Zürich was also very successful, and some very interesting Papers were presented. The Congress, in the same city, of the New International Association for Testing Materials, was a remarkable gathering, in view of the fact that it was the first of the revived body held since 1913. It had particular interest for foundrymen in view of the Papers devoted to the test-bar question, argued for the first time not before foundrymen but before the critical minds of the most outstanding metallurgists in Europe. We propose to return to this question later, but the result is one which is very satisfactory to those who advocate the test-bar. The prospect of international agreement on a standard method of testing cast iron is now greater than it has been for some years.

XUM

Copper Producers in Council.

By "Onlooker."

At the end of October, just five years after its formation, the members of Copper Exporters' Incorporated, are meeting to discuss the present situation. The outstanding problem at the moment is what is to be done about the excessive stocks, and what steps can be taken to reduce production to a point which will balance consumption. Should nothing else be discussed, the copper people will have quite enough to do in overcoming the difficulties which hinder the successful solution of the adverse statistical position; but in striving to put matters right, it will be strange, indeed, if the events of the past few years do not come up for review.

The Copper Exporters have little to be proud of in their record as salesmen, for after five years they find themselves with very few friends in the Old World, where their activities have been most obviously displayed. If one had to say in two words just where the American sales organisation has failed, it would be lack of service. At their inception they openly boasted of their intention to eliminate the merchant, and in this they have succeeded; but their worst enemies would not accuse them of having looked after their customers in the way that a merchant house does. "Take it or leave it" has been their motto all along, and this dictatorial attitude has not unnaturally put the buyers' backs up against them. For months stocks have grown by leaps and bounds, but this has not prevented the producers from pursuing their scheme of limited quotas and refusing to sell to consumers all that they wanted to cover orders received. Every inducement has thus been given to interests outside the combine, and the "umbrella" held up by the Exporters' Association is a wonderful aid to the producers who have not tied themselves up with the shackles that bind the members of the American sales ring.

The net result of five years of mismanagement is that the copper industry to-day finds itself in probably the worst position it has ever experienced, and on the results of the meetings now being held depends the fate of the red metal, for should it be found impossible to agree upon some scheme for placing copper again on its feet, the value is certain to fall still further, as a result of which there would be wholesale closing down of mines in many parts of the world. This state of affairs would in turn lead to a real copper famine—not the "stunt" famine which the Exporters have tried to create by limiting their daily sales to Europe when they had half-a-million tons of copper at their backs—but a genuine shortage of metal, which would create for a time famine prices, and so prepare the way for another glut, such as we are suffering from at present.

If the Copper Exporters are going to save the industry from disaster and themselves from disruption, they must strive against their inclination to legislate solely in their own interests and without thought for their customers. Stabilisation with the Exporters has meant resisting every fall in values until the market was quite honeycombed with bear sales and confidence was shattered. Therein has been the greatest evil of the past five years—loss of confidence; and if the present organisation is to continue there must be a genuine effort to bring the consumer into the picture again. It would be too much, no doubt, to expect the copper people to invite representatives of the European consumers to attend at their conference, but it would be distinctly helpful.

The head of the Provisional Government of Brazil has appointed a Commission, to work under the Ministry of War, with a view to studying the question of the iron resources of the country and the best means of utilising them, and the establishment of a national industry on a large scale.

I.B.F. Branch-Presidents.

MIDDLESBROUGH BRANCH.

Mr. A. Gilbert Harrison was educated at the Grammar School, Stockton-on-Tees, afterwards attending evening classes on metallurgy at the Middlesbrough High School, and latterly at the Constantine College. He commenced his career under the guidance of Mr. M. Weldon Hanson in the iron- and steel-works laboratories of Dorman, Long & Company, Limited, Port Clarence, and for some years was in charge of the laboratories of the Anderston Foundry Company, Limited, also of Port Clarence. Mr. Harrison is now metallurgist to Thos. Summerson & Sons, Limited, in their recently-acquired motor-cylinder foundry at Thornaby-on-Tees. He is a member of the British Cast Iron Research Association, and at the Constantine Tech-

Mr. A. Gilbert Harrison.

nical College is lecturer on foundry science to the evening foundry classes formed by Dr. D. H. Ingall, D.Sc., F.I.C., F.Inst.P., in co-operation with the Middlesbrough Branch of the Institute of British Foundrymen, upon the Council of which he has served since its inception in 1926.

International Rail Makers' Association.

As previously announced, the International Rail Makers' Association (Irma) on October 1 reduced the price of basic Bessemer rails from £6 10s. to £5 17s. 6d. f.o.b. The price of open-hearth steel rails has been reduced from £6 17s. 6d. to £6 5s. These reductions are said to have been unexpected and to have been decided upon in order to meet more effectively the competition of non-member works.

When polishing soft iron or steel with a file, fill the file with chalk to prevent scratching.

"Debats Talide."—This is the name of a product of pure metallic carbide for use in cutting tools. It is said to have wide ranges of usefulness and almost universal application. It is also stated that a thin coating of the new carbide can be superimposed upon other metallic surfaces, thereby increasing the wearing properties.—"The Iron Age."

Random Shots.

I haven't yet been to the Motor Show at Olympia, but friends who have tell me that this year's show is the best ever. Their verdict is becoming traditional. Each year the manufacturers manage to place on the market at lower prices cars of improved design, higher efficiency and greater luxuriousness. And, marvelling at their prodigious feats of magic, "Marksman" (a simple soul!) anticipates in the future an age when this progress will have attained finality; an age, that is, when automobiles of such magnificence as to outshine Apollo's Golden Car will be made available to the public for a mere song. The owner-driver will take out his song book, write a song and receive in exchange for it the motor-car of his fancy. And the manufacturers will actually make their profits by the publishing and sale of these songs, thereby simultaneously wiping out the reproach that Britain is no musical nation.

* * *

In the steady progress realised in the automobile industry, cast iron certainly has played a part; but opinions as to the relative importance of that part are numerous and diverse. Mr. Pomeroy, for instance, last June, allowed it no more than a walking-on part; whereas the latest publication of the Bureau of Information on Nickel, B8, gives it a respectable speaking part. All very confusing to the weathervane sort of mind! Let me be frivolous and declare (with no authority whatever) that only by the sterling work of our brilliant young metallurgists and foundrymen on the properties of cast iron is the motor-car what it is to-day—a motor-car.

* * *

Reverting to my paragraphs of last week on the topic of Safety First, Miss Nellie Snookers (yes! of the Gayway Foundry, Eastbourne) has written to me as follows:—"I have just read your horrid attack upon Safety First. Knowing you as I do, I cannot expect you to have the slightest sense of shame; but I demand that you recant the ill-considered views you so wantonly expressed. It is men like you who make the world a dangerous place in which to live; who cause 21.4 per cent. of the London omnibus drivers to suffer from nervous breakdowns." There, let me assure you, Miss Snookers is quite, quite wrong. It is the London omnibus drivers who cause 21.4 per cent. of the men like me to suffer from nervous breakdowns.

* * *

To resume: On the fourth page of her letter Miss Snookers suggests that the only way in which I can make amends is by telling you of the Safety First precautions which are being taken in the Gayway Foundry. "All the employees engaged in the foundry itself (she states) are encouraged to wear steel-lined hats as a safeguard against falling objects. For body protection I advocate the wearing of a steel-link jerkin, similar to the chain-mail vests to be seen at the Victoria and Albert Museum at Kensington. Boots lined with asbestos effectively eliminate the risk of burnt feet due to metal splashing from ladles. There were once frequent cases of burnt hands owing to the men handling hot castings. These also are now eliminated, as the moulds as soon as poured are conveyed automatically into large refrigerators, where they remain for the next twelve hours. We find that the castings obtained after this treatment possess quite remarkable physical properties." So I would imagine!

Marksman.

"Migra" Iron, a New Special Pig-Iron for High-Quality Castings.

By E. Piwowarsky and A. Wirtz.

(*Translated from "Die Giesserei," No.* 36, 1931.)

During the past six or eight years, well-known practical men and scientists have developed methods which make it possible to produce a cast iron of valuable mechanical and physical properties by an intensive superheating of the iron charge or a subsequent heat-treatment of the cast iron. These methods, however, are rather expensive, and not all foundries are in a position to use them. It is obvious, therefore, that many foundries try to avoid these methods and prefer to use special pig-irons for the production of grey cast iron which will meet the more severe requirements of recent years. As far as low-carbon iron is concerned the problem may be considered as solved by the use of cold-blast or other special grades of iron such as the "Silbereisen" of the Friedrich Wilhelms-Hütte.

Things are, however, more complicated with high-carbon irons for foundry purposes. In applying certain observations made in the field of inherent properties, attempts have been made to produce with fine-graphite pig-irons, obtained by pouring the iron into moulds or by melting the pig-iron under a thick slag especially with high alumina content,* a grey cast iron, which will retain its tendency to form a fine graphite structure after being remelted in the cupola. Unfortunately it has not been possible to prove conclusively by systematic experiments whether those considerations, justified as they may be, will be substantiated by results from large-scale production. The authors have, however, been able to demonstrate that the problem is too complicated to be solved merely by means of the theory assuming the formation of graphite nuclei (germ theory). In a cupola of 400 mm. (16 in.) dia., charges of pure hematite and 75 per cent. hematite plus 25 per cent. steel scrap respectively were remelted with a coke charge of 12 per cent. In one case the hematite iron from the blast furnace has been poured into sand, in the other case into cast-iron moulds. Although the final analyses, as well as the melting and pouring conditions, have been identical no differences were found between the mechanical and physical properties of grey cast iron. So far, however, contrary to the expectations and results from laboratory investigations, the influence of undissolved graphitic particles has been vitiated by other variables of yet unknown causes, as shown by the following experiments:—

Several tons of a low-carbon pig-iron were poured partly into sand, yielding grey cast iron, partly in iron moulds, yielding white cast iron; by subsequent annealing a part of the latter iron was ferritised, temper carbon being formed simultaneously. The irons had the following chemical compositions:—

	T.C.	Gr.	Si.	Mn.	P.	S.
Grey iron ..	2.61	2.05	1.55	0.55	0.10	0.024
White iron	2.55	0.10	1.58	0.54	0.09	0.023
Malleablised white iron	2.66	2.58	1.57	0.54	0.09	0.024

These three types of iron were remelted under identical blast conditions in the above-mentioned 16-in. dia. cupola with a 12 per cent. coke charge and an addition of 7 lbs. ferro-silicon per 220 lbs. iron charge. They were poured under same conditions into bars and various castings (shrinkage test-pieces, grates and spirals for the determination of tensile strength and fluidity, respectively, etc.).

The remelted products had the following chemical compositions:—

Remelted from:	T.C.	Gr.	Si.	Mn.	P.	S.
Grey iron	3.59	2.90	1.88	0.41	0.07	0.046
White iron	3.64	2.94	1.88	0.37	0.07	0.051
Malleablised white iron	3.64	2.90	1.83	0.40	0.08	0.047

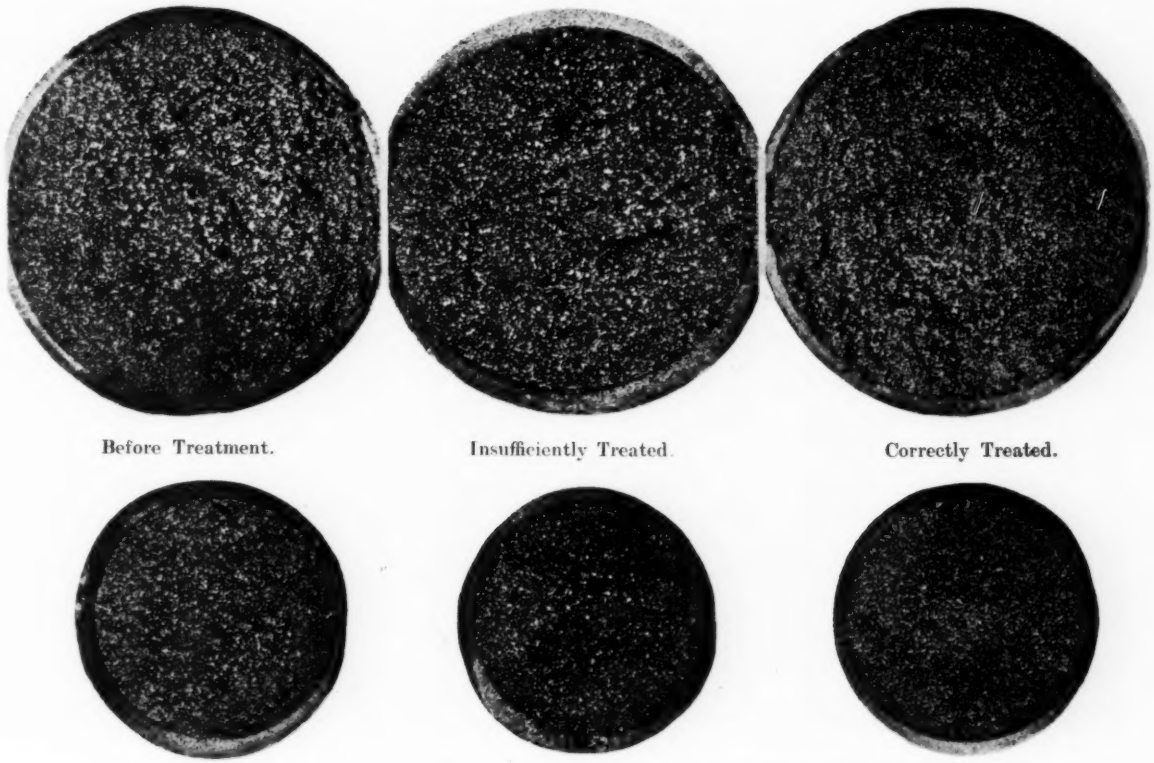
On examining the shrinkage test-pieces,† the grates and spirals, no substantial difference could be found. The static mechanical tests had the surprising result that the grey cast iron showed the best properties, according to the following figures representing the averages of eight values:—

Remelted from:	Ultimate strength.		Transverse strength.	Deflection in in.
	Kg. per sq. mm.	Tons per sq. in.	Tons per sq. in.	
Grey cast iron ..	19.4	12.3	20.5	0.33
White cast iron..	14.5	9.2	16.3	0.29
Malleablised white cast iron	13.4	8.4	17.0	0.34

It will be seen from these figures that the results were different from those one might expect from the theory of inherent properties, and that the formation of the graphitic structure in pig-iron in its bearing on the properties of the remelted product may be influenced by other variables.

By a special thermal-treatment of the iron from the blast furnace before pouring it into

Original Size.



Before Treatment. Insufficiently Treated. Correctly Treated.

Fig. 1.—Influence of the Special Heat-Treatment on the Fracture of Round Bars.

* See, *e.g.*, "Archiv für das Eisenhüttenwesen," 5 (1931), No. 1, pages 1-8.

† Cook, Schwartz, Bureau of Standards.

pigs, it has been possible to establish systematic relations between the quality of the grey cast iron produced by using this special pig-iron. For the heat-treatment mentioned, the molten iron was transferred in large ladles from the furnace to the refining apparatus, where the thermal-treatment was performed.

This thermal-treatment is based on the principles of superheating the iron, although it will require the observance of certain given limits for temperature and time of treatment, which differ considerably from the data published so far in literature. As the new special pig-iron is characterised by a remarkable fine-graphite grain and fracture, it has been given the trade name "Migra" Iron (*Micro-Graphite*).

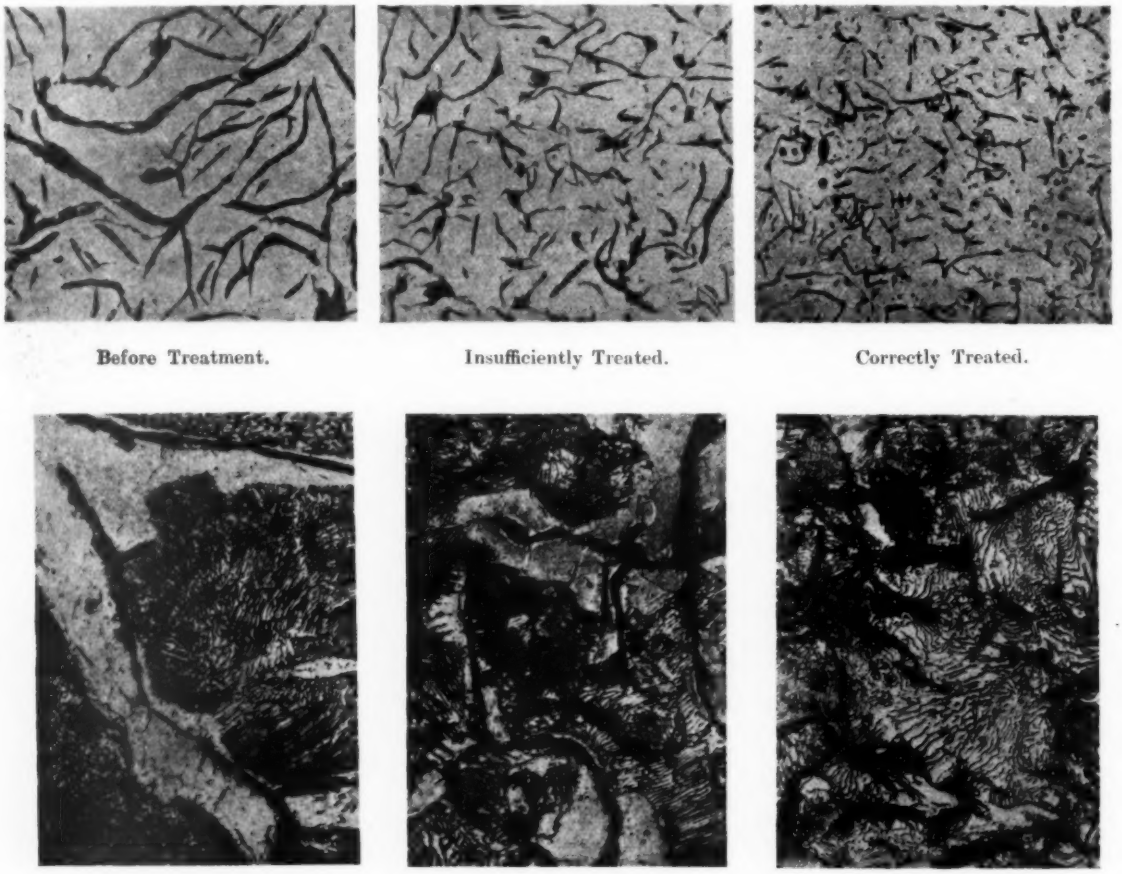
sq. in. In this burden the hematite iron was gradually replaced by the Migra Iron (hematite from the same blast furnace, but refined), as shown by the preceding table.

The iron was always poured at temperatures between 1,340 and 1,320 deg. C., *e.g.*, into standard transverse test-bars and castings for the determination of the influence of wall-thickness (80, 60, 40 and 20 mm. dia.). The chemical analysis was as follows:—

Burden.	T.C.	Gr.	Si.	Mn.	P.	S.
I ..	3.60	3.02	1.22	0.40	0.40	0.097
II ..	3.56	2.90	1.12	0.38	0.38	0.100
II ..	3.50	2.81	1.14	0.40	0.38	0.108

mination of the sensitiveness to the influence of the wall-thickness vary with the burdens I to III from 4.0, 3.9 and 3.3 tons per sq. in., respectively, the Brinell values showing a difference of 44, 41 and 36 units, respectively.

As regards the figures of Table I, it must be noticed that there was no intention to give selected values; on the contrary, a cast iron with high carbon content was chosen. This shows that the advantage in using Migra Iron instead of the ordinary hematite iron is quite obvious. It is very peculiar that the refined qualities imparted to the Migra Iron will also be reproduced in the remelted product, but only when the intermediate thermal-treatment has been performed in a suitable manner. As the improve-



Before Treatment. Insufficiently Treated. Correctly Treated.

Fig. 2.—Influence of the Special Heat-Treatment on the Graphite and the Etched Structure.

Upper photomicrographs unetched. × 125. Lower photomicrographs, Etching No. 2. × 500.

Figs. 1 and 2 show the variations of the fracture, the formation of the graphite and the microstructure of the pig-iron from the condition as tapped in the most suitable condition. An extended thermal-treatment still resulted in the formation of a fine graphite grain, but it was accompanied by a gradual decrease of the mechanical properties.

With this Migra Iron, systematic melting experiments have been carried out in the above-

	Burden.		
	I.	II.	III.
Hematite iron, per cent.	50	25	—
Migra Iron, per cent.	—	25	50
Foundry pig, per cent.	15	15	15
Cast-iron scrap, per cent. ..	25	25	25
Steel scrap, per cent.	10	10	10

mentioned 16-in. dia. cupola under always identical conditions, with a burden which normally results in an iron with a tensile strength varying between 11.5 and 12.7 tons per

Table I.—*Results of Mechanical Tests.*

Burden.	Bend strength*, 30 × 600.		Deflection* in.	Tensile strength of test-piece for determination of influence of wall-thickness, in tons per sq. in.			
	Kg. per sq. mm.	Tons per sq. in.		80 mm. dia.	60 mm. dia.	40 mm. dia.	20 mm. dia.
I	35.6	22.5	0.42	9.0	9.0	11.0	12.4
II	38.6	22.4	0.44	11.6	12.0	12.7	15.5
III	40.8	25.9	0.42	13.6	13.8	14.5	17.4

Burden.	Tensile strength,* test-piece of 20 mm. dia.		Impact strength, 30 × 30 mm. without notch.	Brinell hardness of test-piece for determination of influence of wall-thickness.			
	Kg. per sq. mm.	Tons per sq. in.		80 mm. dia.	60 mm. dia.	40 mm. dia.	20 mm. dia.
I	19.5	12.5	0.63	154	168	174	198
II	22.0	14.2	0.61	167	179	180	203
III	24.5	15.7	0.69	182	192	193	223

* Average from six bars each, cast 30 mm. dia.

The results of the mechanical tests are recorded in Table I.

It will be noticed that the differences in the tensile strength of the test-pieces for the determent of the grey cast iron will only become evident after a defined duration of the intermediate refining of the hematite iron used,

(*Concluded on page* 254.)

The Metallurgist in the Foundry.*

By F. S. Wordsworth.

It has recently been stated that Carnegie was responsible for the first introduction of a skilled chemist into an American steelworks, an appointment which excited the compassionate smiles not only of his competitors but of not a few of his own officials. The result, however, was that the despised chemist discovered almost immediately that certain ores habitually purchased on their repute were distinctly inferior to others of materially lower price. This is an instance applied to a steelworks, but even at this period of the rapid progress that cast iron is making—from a material which engineers used but never understood, to a material the properties of which are being utilised in an intelligent and rational manner, by the more enlightened craftsmen at any rate; from a material the manufacture of which partook of the nature of "chuck in a lot of old iron and melt it and tap it and put it into moulds and call the 'result' castings," to a material the preparation of which is subjected to the most stringent investigation, to a prolonged and comprehensive research, to the closest possible control at all stages—there are still firms whose directors, managers and engineers refuse to credit the value which can be received from the correctly-applied and properly-encouraged metallurgical control and research in the iron foundry.

Status and Duties of the Metallurgist.

The conception of a metallurgist, so far as this Paper is concerned, is a chief metallurgist working in conjunction with an adequate and efficient staff, in a properly-equipped laboratory to control the different sections of the metallurgical department and the duties thereof.

Metallurgical control of the iron foundry does not mean that the metallurgist should replace the foundry manager or that the metallurgist should endeavour to show a practical moulder how to make a complicated mould, or, in other words, that the metallurgist should be head of the "shop." Far from this—but it is insisted that the purpose for which a metallurgist is present in the foundry is, that he is the correct person to control the metal side of the foundry routine. Let the moulder mould and let the metallurgist attend to the production of the metal, and from their respective spheres the metallurgist and the foundryman can co-operate to obtain the best results from their individual sections for the foundry requirements.

Co-operation is a vital necessity between these personages. It is of no benefit for the metallurgist to carry out a series of experiments and tests to obtain a better quality of casting, be it from the point of view of value in service, economy of material and lessened cost due to decreased sections of iron appropriate to improved metal, or in any other manner, if the foundryman, or anyone else, is unwilling to make a just interpretation and a correct use of his results.

The metallurgist is a being whose work, apart from routine work, consists of continuing the use of previous discoveries to their greatest advantage, and utilising knowledge already gained from those earlier successes to influence the direction of his efforts to achieve something greater still.

The metallurgist has frequently to make experiments of which results he is totally uncertain, but by which he may be enabled to make some small degree of progress towards the ultimate and infinite objective of a perfect cast iron.

Mr. Enström, the director of the Academy of Engineering Research at Stockholm, maintains that as matters stand to-day, the successful development of novel ideas is hardly practicable without the assistance of the laboratory and the trained research worker. In the daily conduct of well-established manufacturers little may be required beyond experience. Where, however, new departures are being made, mere experience is totally inadequate and often misleading; what is then required is some mastery of physical and mechanical principles. If this be true in a mechanical profession such as engineering, how much more so is it to be applied to the highly scientific business of the alloy termed cast iron.

It has been said "that any man who can say what any particular lot of cast iron will do is a genius." Whilst not agreeing with this statement in its entirely literal sense, in a broader way it puts the whole difficulty in a nutshell.

The metallurgist mixes his pig-irons, combines known amounts of this grade with certain quantities of that grade, bearing in mind all the time the purpose for which the melt is required, and, although he knows exactly of what each pig-iron is composed and what properties each grade has, he cannot say with absolute certainty what the resultant melt will prove to be until he has tested it out and tried it in the usual manner. The most surprising failures from mathematical certainties have been experienced and good results have been obtained from the reverse; but, though it is largely a gamble all the time, a due consideration and a sound knowledge of the raw materials is far preferable to a haphazard method of just varying each factor in turn in the Micawberish hope that something will turn up.

Eliminating Variables.

Sir J. J. Thompson points out that theory of probability indicates that in such cases progress is proportional only to the square root of the effort expended, whereas where theory sets the course progress may be in direct proportion to effort. One great thing, luckily for the peace of mind of the metallurgist and of the iron-founder, and it is almost invariable, is that when results are established they are constant if other influences remain the same, and not as reported, are always needing a genius on the job.

To ensure that these influences remain the same is yet another problem for the metallurgist to consider and solve. The process of the cupola melting or any other method of manufacture of cast iron is such a complicated problem that the foundry manager, whose time is, or should be, spent in supervising the "floor" and the "core shop" or in the office with schedules and labour sheets, and whose assistant is often a promoted moulder whose ideas of melting come of experience in the rough and ready school, though he may be a splendid practical moulder, cannot possibly hope to keep an efficient supervision over the dozen or so variables whose influences, either singly or collectively can so effect the final qualities of cast iron.

Here it is, with the proper equipment, that the metallurgist can safely assure the foundryman that Monday's iron will be like Friday's iron if, of course, it is required to be the same. In every detail he can be sure of a regular and constant melting of his charges of selected pig-irons and by his supervision he can largely eliminate that most difficult of all problems to solve, the human factor. In these days this accounts for more "bad" melts than any other single cause.

In recent years it has become the practice to pay far more attention to the condition of the sand used both for facing and backing and also on the core benches. Metallurgical control has crept in here, and close research has to be made into the results of various admixtures of sands, core compounds, oils and pastes. The milling and the resultant preparation has to be tried and tested in a similar way to which metal mixtures must be tried, before use, in a routine way.

Here, again, comes the human element. One man's shovelful is another man's bucketful, etc. Thus, once more, it is necessary to have a supervision and a control if there is to be any guarantee that such things as moisture, permeability, etc., are to be at all standard from day to day. With the demand from the engineers and the cost offices of better quality of castings and cheapened cost of production respectively, there has grown a call for a better finish, an improved surface or skin upon all sizes of castings, and it is essential, in order to meet this outcry, to pay attention to sand—the principal factor in obtaining such specially perfect surfaces.

Whilst the research side of the metallurgist's duties occupies a considerable portion of his time, it must be remembered that the metallurgist must make use of knowledge already gained from earlier experiments, not only in the continuation of these researches but also in the execution of the daily routine of the foundry by the metallurgical organisation. It thus follows that records must be kept, not only of experimental work, but of the resultant practice of these experiments in the daily routine. A daily, or even in some cases an hourly, check is required to ensure that no serious deviation from standard conditions is allowed to creep in and remain undetected and unchecked. It is of paramount importance that if the metallurgist is to do justice to his position and to enable the greatest value to be gained from his services he shall have the fullest confidence of the firm and its management, and that he should be entirely free from petty restrictions.

Assistance Rendered by B.C.I.R.A.

It is necessary that the metallurgist be a free agent, and that the fullest use should be made by him of every possible source of information likely to assist him in his work or that is likely to have a bearing thereon. In far too many cases does a metallurgist become a mere routine machine, whose time is merely spent supervising a testing department. This is often so, due entirely to the lack of encouragement and facilities for progress, and the metallurgist loses heart and becomes little more than a works chemist. Recognition of the enormous value of research work by metallurgists in the advance of the position of cast iron was adequately emphasised by the Government grant made some years ago to enable the British Cast Iron Research Association to be established, and in the continuance of these grants, even in these hard times, from the same source to enable the Association to go forward with its work for the advancement both of foundry practice and foundry science. The successful work done at the laboratories of the Association at Birmingham and Falkirk, and the discoveries made at Sheffield University, where Dr. J. G. A. Skerl is in charge of the investigations into various foundry sands, and their suitability for different requirements, are invaluable. Whilst the Association does not, and is not intended to replace the regular metallurgical staff of any of its members, it does help, and is of very great assistance, when problems too intricate or large for a works staff to undertake arise.

In this respect it has been necessary for the Association to take the initiative by offering to assist in or even actually develop for the industry its own research results, as firms were either unwilling or were not equipped to carry out this work. Then it renders its assistance to members by means of its various advisory committees, upon which are to be found the names of the most prominent members of the scientific, technical and metallurgical professions, in addition to those members whose names are house-

* Paper presented at the first meeting of the recently-formed Lincolnshire Section of the Institute of British Foundrymen, Mr. J. Feasey presiding.

hold words amongst the craft. Year by year the importance of this work by the Association will grow, and as the membership increases with the recognition of the need for skilled advice, so will foundries who have not already recognised metallurgical control, instal and maintain their own staff of metallurgists to be ready to hand to deal with the array of daily problems.

Research Should be Financed Now.

It is those firms who realise these things now, during the times of bad trade and slumps, who are going to seize the markets when the boom comes, and the demand for special alloy irons and high-test, high-duty and various other kinds of metals, becomes such a clamour that only those who are ready will stand any real chance to reap part of the goodwill of the buyers. This is the time when money should be spent in research work and experiments; this is the moment when there is time fully to follow experiments to the end, and not find that they are crowded out by necessary routine work that is inevitable when a firm is busy.

In his Presidential Address to the London Branch, Mr. Dews said "Time is obviously necessary. It is not possible to put research results into practice in a few minutes and start earning dividends right away. One must be prepared to face a period when plant and staff are earning nothing. Competition may be pressing hard, and management may be tempted to jeopardise the new research development by seizing a temporary market. Research development calls for patience against the inevitable delays and setbacks and for faith in the ultimate result. There must be no carping that theory does not appear to be immediately realised in practice. In most cases it is not, as commercial management is prone to suggest, that theory is wrong. When theory and practice do not agree, it is more often than not practice that is wrong."

DISCUSSION.

Opening the discussion, Mr. J. Feasey (chairman) said there was a good deal to be said for the research side, and Mr. Wordsworth has made it very plain what is wanted.

Mr. Mather, agreeing with Mr. Wordsworth's conclusions, said that in the workshop many jobs would be salved if a chemist were available. It was necessary for close co-operation between the foundryman and the chemist.

He recalled a case, some years ago, where the chemist had given a certain mixture for cylinder irons. The foreman was not enamoured of the chemist. When the casting failed, and the chemist was making inquiries, the cupola tenter said the mixture had never been put on the cupola, so it was unlikely to find the results expected. If the foundryman would work with the chemist, good results would mature.

Mr. P. A. Russell said that as the smaller foundrymen could not afford to employ the chemist, he thought every foundry manager should have a fair metallurgical knowledge. The metallurgist obviously should have control of the cupola charges. He instanced a case where he had given a mixture using steel scrap. When matters went wrong, he went on to the cupola stage and found the men were charging returned semi-steel scrap for steel scrap. He agreed with Mr. Wordsworth that the chemist should go on to the cupola staging and supervise the charging.

Mr. E. Stevenson asked "Who should control the foundry—moulder, patternmaker, draftsman, metallurgist or engineer?" His idea was that of a moulder with experience in patternmaking and drawing office, 3 or 4 years in the metallurgical laboratory and about 2 years in the engineering shops. Such a man would be a super-man, and since he cannot be found there must be close co-operation between each department. Even then, there was always the human element to contend with; if the cupola tenter misses one charge of coke the whole control is ruined.

One Executive to Assume Control.

Mr. Harley said he had often heard the question, "Who should control the foundry?" and he did not believe in too much of the co-operation in the sense indicated. The foundry manager should manage the foundry; there can only be one man in charge. It did not matter whether he was moulder or patternmaker, so long as he was the right man. As well as knowing his trade, he must have the knowledge of managing men. The foundry manager should be in control of the foundry, the laboratory and the pattern-shop. He should give the metallurgist elbow room, but should have enough knowledge of metallurgy and the laboratory to control the metallurgist. It was up to him how much latitude he would allow the metallurgist, but undoubtedly one man should be in control.

Mr. Feasey said he agreed with the remarks of the President. In his younger days he had gone through the foundry, and had taken a course of draftsmanship, and also he had taken a first diploma for patternmaking. He then had seven years' teaching at the Technical College before taking up an executive position in the foundry.

The Chairman, in closing the discussion, asked Mr. Makemson to address the gathering.

Value of Institute Discussions.

Mr Makemson congratulated Mr. Wordsworth, firstly, for his Paper, and secondly on his enthusiasm and his success of the initial work on behalf of this section. Previous to this meeting there had been a vast amount of work behind the scenes. The success this Section was certain to enjoy would be due to the spade-work already done. He appealed to those who were members, and to those who were not yet members, to continue the work and bring it to fruition. The best way was to help to increase the membership and make it more useful. A man might ask, "Why should I join?" He might have achieved a certain measure of success without joining the Institute. Older members knew what the Institute did through its meetings, discussions, works visits, etc., and thoroughly recognised its value. There was opportunity of making contact with people of kindred interests and discussing their mutual troubles. No foundry can make progress under its own steam. The more one discusses a problem, the easier it will be for everyone to arrive at a proper conclusion. There are members who well understand how many times troubles have been solved. With the current trading conditions it is necessary for its members to get together, and the Institute affords the principal way of doing it.

Mr. Walters, the principal of the Lincoln Technical College, said he was willing to form classes for apprentices and also to bend any of the existing metallurgy classes over to the interests of the foundry. At the present time he had had a poor response to his requests for boys to attend the classes, and he appealed to all members to send along any suitable apprentice.

Mr. Feasey said Mr. Walters had kindly granted the use of the Technical College for the Section's meetings. He thanked Mr. Walters for his efforts to form classes, and assured him of their efforts to interest the boys to attend, but he did not believe in forcing boys to attend evening classes.

Mr. Feasey proposed a vote of thanks to the President and Mr. Makemson for their presence.

Mr. Coleman (vice-chairman) seconded, and also mentioned how sorry they were that they were to lose the services of their hon. secretary, Mr. F. Wordsworth.

Mr. Harley and Mr. Makemson replied, expressing pleasure at being present, and a vote of thanks to the chairman concluded the business.

Cast Materials for High-Temperature Service.

Mr. L. W. Spring, author of the American Exchange Paper given before the recent Birmingham Convention of the Institute of British Foundrymen, on "Some Considerations and Tests for Cast Materials for High-Temperature, High-Pressure Service," writes, in reply to the discussion of his Paper, that, apparently, several of the data which were given in the Paper were of considerable interest to British steel-foundrymen, as indeed they are to American foundrymen. Mr. Dews called particular attention to the matter of creep strength of castings in comparison with that of forgings. Mr. Spring's results had shown this superiority regularly, the first announcement of this finding having been made in the June, 1928, "Proceedings" of the American Society for Testing Materials. At approximately the same time that his Paper was being read in Birmingham, Prof. D. Hanson had stated* that cast materials were more heat-resistant than worked materials, and that it was clear that the heat-resisting alloy of the future had to be used in the cast form.

It had given great pleasure to write the Paper for the Institute, though it was unfortunate that he was unable to be present when it was delivered. The very kind reception which they gave to the Paper was highly appreciated.

Iron and Steel Output in September.

The National Federation of Iron and Steel Manufacturers report that the number of furnaces in operation at the end of September was 62, a net decrease of two since the beginning of the month, four furnaces having ceased operations and two furnaces having been blown in. The production of pig-iron amounted to 248,200 tons, compared with 275,700 in August and 425,000 in September, 1930. The production included 29,300 tons of hematité, 107,400 tons of basic, 89,100 tons of foundry and 12,800 tons of forge iron. The September output of steel ingots and castings amounted to 400,500 tons, compared with 357,000 tons in August and 580,600 tons in September, 1930.

"Migra" Iron, a New Special Pig-Iron for High-Quality Castings.

(*Concluded from page* 252.)

whilst the refining of the graphite of the hematite iron begins a considerable time before,† it must be concluded that the formation of a fine-graphite structure in the pig-iron of the charge alone does not necessarily guarantee the production of a fine-graphite high-quality cast iron.

Migra Iron, therefore, should be used in all cases where it is intended to produce an iron of good casting qualities, high machinability and great density, together with higher mechanical properties. It may also replace charcoal iron in the production of chilled castings, rolls and ingot moulds.

The experiments described here have been carried out in the foundry of the Vereinigte Stahlwerke A.-G. at the Friedrich Wilhelms-Hütte, in Mülheim-Ruhr, where the Migra Iron with low phosphorus content is produced. The Migra Iron with higher phosphorus content is produced in the foundry, at Schalke, of the Vereinigte Stahlwerke A.-G.

Silicon carbide, boron carbide or diamond powder can be used to lap cemented-tungsten-carbide steel.

* Foundry Trade Journal, June 4 and July 9, 1931.

† In using in the cupola a hematite iron not sufficiently refined, the tensile strength of the resulting grey cast iron was increased by about only 1,422 lbs. per sq. in.

Personal Efficiency in the Foundry.

The inaugural meeting of the Scottish Section of the Institute of British Foundrymen was held in the Royal Technical College, Glasgow, on October 3. Mr. James Miller, the retiring President, occupied the chair at the outset.

The minutes of the previous meeting having been read and approved, the CHAIRMAN said that he had now come to the final act in his term of office. He expressed pleasure in seeing so large an attendance, which he took as an indication of the sustained interest and enthusiasm of the members in the activities of their Section. He wished to thank them for the honour conferred on him of being permitted to occupy the presidential chair during the past session, which had been one of considerable importance in the history of the Scottish Section. It had afforded him much happiness to have had the opportunity of doing something for the Branch, and he trusted that his efforts had not been altogether unwelcome. It had given them considerable pleasure when it became known that Mr. McManus had consented to occupy the chair during the current session. Mr. McManus was known to them as a gentleman thoroughly versed in foundry practice, with a wide experience of men and affairs. He felt confident that the members would accord to Mr. McManus the same hearty support which they had given to himself, and that the session would prove to be extremely useful and interesting. It was his privilege to ask Mr. McManus to take the chair.

MR. N. MCMANUS, M.B.E., upon taking the chair, said that in electing him President of the Section the members had conferred upon him an unexpected honour, and he appreciated that honour very much indeed. He felt some doubts as to whether they had made a correct choice, as his own valuation of his capabilities did not coincide with that of Mr. Miller. He would, however, promise that he would do everything possible to help on the work of the Branch and of the Institute. With the assistance of the council and the secretary he hoped that the session would be a successful one.

A chairman was not expected to make speeches but to listen to them; in fact, a chairman should stand up, speak up and "shut up." He asked them to accord a hearty vote of thanks to Mr. Miller, the retiring President, for the excellent work he had done for the Branch during his term of office. When the speaker attended the conference at Birmingham, he was in conversation with a group of people who did not know who he was, but it transpired that some of them had attended the April meeting and had met Mr. Miller, and they had asked him how it was that the Scottish Branch always had such excellent Presidents. He hoped that Mr. Miller would long be with them and ready to give them the benefit of his advice in the future.

The vote was accorded with acclamation.

Certificate Scheme Established.

Mr. McManus said that the next item was unique. As they knew, the Branch was responsible for the founding of the Sir Archibald McInnes Shaw Prize, and the Education Committee of the Corporation had arranged facilities in two schools for apprentices following the Institute's course for the diploma in patternmaking and moulding. The Education Committee had asked the Branch to form an advisory committee to assist in carrying on the classes. It had been the intention of the Director of Education to be with them and speak to the young men and also to the employers and foremen of the advantages of attendance at classes and qualification for the diploma. Unfortunately he had been prevented by other duties from being present. He had, however, asked the deputy director, Mr. Dunlop Anderson, to take his place. Mr. Anderson, who would address them upon the matter of trade classes and the provision being made for them within the City, was not entirely an academic teacher as he was also a trained and experienced engineer. He had pleasure in introducing Mr. Dunlop Anderson.

What Glasgow is Doing to Train Foundrymen.

MR. DUNLOP ANDERSON said that to see so large a number present on a fine Saturday afternoon spoke eloquently of the enthusiasm and interest of foundrymen. Although he was now a professional teacher, he for 15 years had earned his bread-and-butter as an engineer, so that, although he was not a foundryman, he belonged to, and had a connection with, the allied trades. Since the war he had had charge of the technical classes in the continuation schools in Glasgow, and he thought that any progress that had been made was marked at both ends of the scale —the infants, with whom they had nothing to do, and the trades classes, in which they had a particular interest. He was very sorry that moulding and patternmaking had apparently not taken as much part in that progress as was desirable. He did not know who was to blame, but he hoped that something beneficial would result from the efforts of the Institute of British Foundrymen. Equipment was necessary to enable them to organise and improve trades classes, and at the present time it was essential that suitable equipment be provided in the schools, because industry, as it was now organised, did not permit of giving the apprentices the same facilities for learning their craft as were given fifty years ago.

They had established very successful classes in a number of trades, as, for instance, in printing. The demand came not from the education authorities but from the trade itself, and they had what was admitted to be the best school of printing outside of London. They had a scheme of apprentice-training in day continuation classes, not yet complete, but it was the thin end of the wedge, and he expected that in three or four years' time all apprentices would be allowed time for day-training. The master printers and trade unions were really responsible for the success of the printing classes, and they had given valuable help in providing machinery and money. They realised that if Glasgow was to hold its own in the trade, then good training had to be given. In the case of joiners and carpenters, they had over 85 per cent. of the apprentices attending classes in well-equipped workshops. There was a special reason in this case, as lads received a bonus for attending the courses of instruction.

In the case of engineering, however, they had met with difficulties, and if he offered any criticisms he would say that the course was too technical and arranged too much to the requirements of draftsmen and not the men who worked at the bench or in the shop. Possibly the same thing applied to the moulding and patternmaking classes. The case of the marine engineer was interesting. The classes failed completely to attract the men—that is, the men who served a mechanical-engineering apprenticeship and then went to sea. He had raised the entrance qualifications some years ago, and charged a higher fee on the principle that what is got for nothing is worth nothing. He was told that he would ruin the whole scheme. He did not mind neglecting the classes for two or three years whilst he was making a foundation, and the result was that this session it had been necessary to engage seven additional teachers. There were over 400 this year taking the five-year diploma course, and after that they could attend classes in special subjects, such as Diesel engines and marine oil-engine courses.

The President had referred to the McInnes Shaw Prize, but the speaker was not so much interested in the prize award, as the man of parts got on in any case. In the case of the ordinary apprentice, who would be all his life at the bench, he thought the best thing was to raise the standard of efficiency of the ordinary lad. The all-round clever fellow pushed ahead, in spite of everything.

They could do for the moulders and patternmakers what had been done for marine engineers, if they tackled the matter in the right way. It had always been thought necessary to include a lot of physics, mathematics and the like in the moulding course, but, really, when apprentices asked what was the good of it, he had some sympathy. The question was: What was to be done with the foundry apprentices? At the moment industry was slack and few boys were being engaged, but were they satisfied that they were really getting the right type? He found that since about 1920 the numbers in two foundry classes averaged 80, but this year had dropped to 51. He was not, however, discouraged, because it was no uncommon thing for numbers to flock to a class in one year and fall the next. Just as in the foundry they scrapped a bad casting and made another, or altered a pattern and got on with the job, they had to get on with the job of providing suitable training for the apprentices. He was always delighted to let other people do the work. Masters and union officials had done it in many cases, and if matters matured properly they got the praise, but, if otherwise, he took the knocks. He therefore wanted them to do the work in the case of foundry classes.

He thought the patternmaking and moulding classes had not been so successful because the foundrymen had not done their work; the sooner the Advisory Committee got on with the job the better. There had been adverse circumstances owing to complaints of education rates being too high, day schools had to be provided, and the provision of accommodation had been a difficulty with every education authority. The education authorities had not done their part for foundry classes, as they had not the accommodation or the equipment that there should be. They were now busy with the new trades school, which had a good central position and was in the district where, in the past, the most successful foundry classes had been held. They had made provision for a foundry and patternmaking classes in the new school, and he would guarantee to see that proper equipment was provided in some way or the other under guidance of the Advisory Committee. It was for them to do the rest, and he would be delighted to carry their views to the Education Committee of the Corporation. He was convinced that there were as good apprentices in their trade as in any other; they had not had the same opportunities in the past, but foundations were now being laid.

Vote of Thanks.

MR. A. CAMPION, in proposing a vote of thanks to Mr. Anderson, said that the Institute had spent a great deal of time in recent years in discussing the training of foundry apprentices and compiling the syllabus for diploma courses. He was glad to know of the interest of the education authorities and of the provision they were making in the new school. The scheme which the Institute had initiated in conjunction with the City and Guilds of London Institute represented, in his view, a much-needed departure from the ordinary course of foundry classes. In the past such courses had always been arranged on highly technical or academic lines, in fact university-degree lines. Provision had been made for about 5 per cent. of the foundry employees whilst 95 per cent. were neglected. The Institute's scheme legislated for the 95 per cent. for the first time, and was arranged on practical lines such as he had for many years advocated. It had previously been deemed necessary to insist upon the possession of an intermediate or leaving certificate before entering upon the course,

which consisted mainly of mathematics, physics, chemistry and more chemistry for three years; those who survived then got, perhaps, an evening a week in the fourth or fifth year of foundry lectures. Was there any wonder the lads asked, what is the good of it? And threw up the whole course.

The idea of the new course was to retain interest throughout by starting immediately with descriptive foundry work and explaining the principles upon which certain operations were based and the reasons for the use of certain materials for certain purposes. Equipment was necessary for practical work, and he was glad to learn from Mr. Anderson that provision for a foundry had been made in the new school. He could assure him that the Scottish Branch would be ready to help in any way possible, and he thought that within the City of Glasgow Mr. Anderson would easily obtain any information he might desire. He asked them to accord a vote of thanks to Mr. Anderson for his interest and for coming to address them.

Mr. J. Longden said that Mr. Campion had practically summarised his own views and, he thought, those of most foundrymen. They realised that in the past the training in evening classes had been conducted too much on the academic side. He would like to mention that the foundrymen worked very hard, and that any apprentice, who, after a day's work, had the will and vigour to face two or three nights' work a week had to be regarded as an exception. The foundry was more exacting than any other industry, so that the foundry apprentice was in a different position from any other and, he thought, should be treated with more consideration as regards night study. He felt sure that Mr. Anderson would do everything possible to help them.

Classes Too Theoretical.

Mr. Anderson agreed with all that had been said. He was interested in the work of training of apprentices, and thought that although technical classes might be held on three nights per week, trade classes should be held on two. In the new school the courses would be on the basis of two nights a week. Mr. Campion knew how physics and chemistry were liable to be pushed in by authorities. Those who opposed that view did not always lose, however; they did not affiliate and go on their own way. He had a pet scheme of his own, as he realised how difficult it was for the average apprentice to do homework. He wanted the trade classes to be real centres of knowledge, and hoped to arrange for certain rooms or workshops to be at the disposal of students at any time for study. They would not go to be taught, although he hoped to be able to arrange for someone to be in attendance to discuss little difficulties or to answer questions. That, he thought, would encourage the lad to true study under work conditions. He thanked them for inviting him to be at the meeting.

The President assured Mr. Anderson that, as an Institute, they would do their best on the practical side to assist him in organising and conducting the foundry classes.

Personal Efficiency in the Foundry.

Mr. McManus then delivered his Presidential Address, in the course of which he said: Mr. Miller and gentlemen, It is difficult to formulate an address which would deal with a subject having a new note and opening up a fresh field for vision. Unfortunately, this is impossible, for somehow the mind, with its limitations, and possibly biassed with the knowledge that the nation is passing through a critical period in its history, both in industry and in finance, admits no other thought from a business point of view than the constant inquiry: How do we stand when the dark clouds begin to disperse and a trade revival sets in; are we in a position to add to our quota? There is a task ahead of this great nation, a task of such magnitude that it calls for the earnest co-operation of all in an endeavour to increase the efficiency of the manufacturing industries, so that at the first sign of that revival it may be better prepared to meet competitors in the world's markets.

This address has been given the title "Personal Efficiency in the Foundry," but a more appropriate heading would be "A Rough Outline of Attaining Great Efficiency, with special reference to the 'Human Machine.'" What are foundrymen doing in this direction? Probably the general reply would be that they are endeavouring to reduce costs and sell their products as cheaply as possible. Many have already progressed a long way in this direction, and on efficient lines. When we talk about reducing costs, it is necessary that there should be an aim or an ideal to strive for, and also that it should be set high enough to be always in sight, yet just out of reach.

At this juncture the words of Jonathan Swift, written two hundred years ago, are very appropriate and worthy of repeating. They are:—

"*And he gave it for his opinion, that whoever could make two ears of corn or two blades of grass to grow upon a spot of ground where only one grew before, would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together.*"

It is the spirit of these words that one needs to absorb. What is required to attain this goal is imagination, self-reliance and vigorous leadership, not Acts of Parliament.

Necessity for Greater Output.

The problem postulated is: How can one obtain greater output, the quality remaining the same, without calling forth greater physical effort on the part of the worker? Only by organising and making the conditions such that the worker can give of his best, and that the facilities and assistance, in whatever form provided, though increasing production, will enable this to be done with the minimum of fatigue. An ambitious aim, no doubt, and to deal in detail with every phase which this subject now opens up is much too wide in its scope for such an address as this. It is proposed, therefore, to restrict it to "Efficiency, and what it stands for."

A varied experience in many capacities has indicated very clearly that there are large sums of money being lost due to waste of time, energy and material, mainly due to want of a definite system and aim. One hears much about "efficiency," but if people would only talk more about "inefficiency" it would undoubtedly serve a more useful purpose, for, after all, what is efficiency? Nothing more or less than the elimination of inefficiency, which means waste in some form, after its discovery. There is no golden rule or royal road to accomplish this, though there are many broad principles to be followed. Each operation must be analysed and compared with a perfect condition, "our ideal just out of reach," making due allowance for the shortcomings of human nature, and then a practical standard fixed for each.

The Case of the Small Foundry.

Unfortunately, not until the last few years has the question of foundry production received anything like the attention previously given to the engineering side of industry, but once this attention has been focussed on the foundry, the possibilities of improvement that are opened up have been a revelation. The small foundry can benefit by the use of proper methods and facilities, just as much as the large one, and if put on right lines there is no need of having to make radical alterations as expansion takes place. There are many foundries of modern construction, but, unhappily, far too many otherwise; much, however, can be done with the latter, though they do not readily lend themselves to efficient control. The ideal foundry is one so constructed that all material moves in straight direct lines from start to finish, with no backward and forward movements. However, even in the oldest of foundries, much can be done by a careful study of the conditions and a general clean-up, to improve its efficiency.

If those in control of foundries would make a large-scale plan of their buildings and trace out the path traversed by, say, the mould and all items pertaining to it, from the receipt of the pattern to the ultimate despatch of the casting, the result would be, in many cases, as startling as the zigzag flashes of lightning the lines would portray. With some rearranging of floors and plant and no great expense, here is scope for the elimination of much wasted time and energy, having regard to the large amount of material to be handled to produce one ton of finished castings.

Elementary Considerations.

Light and pure air are free to all, but judging from the appearance and atmosphere of some foundries, one would not think so. If light, pure air and relatively clean working conditions are essential for engineering shops, then why are there so many dark, dirty and untidy foundries? Surely for want of an ideal. Dirty and crowded surroundings, poor air, insufficient light and warmth undoubtedly produce poor work, both as regards quantity and quality, and the general atmosphere reeks of inefficiency. Here, again, a further step can be taken where needed to clean up and let light in through the windows which were intended for that purpose. Providing for the welfare and comfort of the workers is a proved sound business proposition, and has no claim to philanthropy, though undoubtedly it is to the mutual advantage of employer and employee.

Importance of the Human Element.

Contented workers are a real asset, and can only be such when the working conditions are cheerful and bright, and there is mutual confidence, which is absolutely necessary between all parties, from the manager, through the foremen, to the worker. There must be square dealing all round, which calls for co-operation. In the words of Harrington Emerson, "*Co-operation is a matter of course, not a virtue; its absence is a crime.*" The contact between the management on the one hand and the worker on the other is maintained by the foreman. It is in this capacity that he plays a prominent part, standing, as he does, midway between them. His methods and dealings with those under him are taken in a general way as representing the policy of the management. So upon the foreman lies the responsibility of reflecting, through his control, the aims and desires of those above him and of maintaining the true spirit of co-operation, so essential to progress. If the human side of foundry business is being stressed, it is because it is felt that it is not so readily appreciated nor realised how important this factor is, when striving for improvements. Without honest co-operation the best facilities and machinery count for little.

Reaction to Changes.

When changes in methods, manufacture or systems are instituted, there is generally an impression among employees that something is taking place which may be detrimental to their interests, and in some cases they offer a sort of "passive resistance" to the innovations. Primarily, it is as well to remember that every change in method or machinery, having efficiency for its object, should not increase but rather reduce the physical effort on the part of the worker, and secondly, if he is assured the change does not mean a reduction in earnings, but may possibly produce an increase, then "mutual confidence" comes into play to remove the doubts, for if they be on correct lines it will be realised that it is in the interests of all concerned. Should such changes be revolutionary in character a certain amount of caution is needed.

The words taken from E. T. Elbourne's book, "Factory Administration and Accounts," express this meaning more clearly.

"Reorganisation that touches the habits of men should 'hasten slowly.' The taking on of new habits and the shedding of old habits should be made natural by stimulating the interest of those concerned in the new methods."

Progress Impeded by "Safety First."

This in turn prompts a further warning in another direction. Executives must be on guard against accepting the view that long-established methods and practices, though producing satisfactory results, are immune from improvement. Risks have to be taken in the foundry, as in other walks of life, if progress is to be made. In progress there is no room for "Safety First." Mr. Gardom, in his address to the London Branch of the Institute, dealt with this point very aptly in the following excerpt:—

"Excellent as Safety First methods may be in many spheres, they have no place in progress. Our country, and our industrial supremacy was built up by taking risks in the spirit of adventure. I do not suggest the opposite slogan, 'Thoughtless Rashness.' This is just as foolish as being too careful to avoid it."

A simple example of the "Safety First" principle may be found in the making of some oil-sand cores. Iron grids are often used for reinforcing the core, when a few pieces of iron rod, suitably shaped, are all that is required. The old method of making ordinary sand cores certainly needed the grid, so habit and Safety First prevented the use of plain iron rods in the oil-sand core. A great deal of attention has been, and is being, paid to the efficiency and improvement of foundry plant for reducing hand labour. The columns and advertisement pages of the foundry trade Press being only one instance of many which bear witness to this. Undoubtedly, executives have not been quite so serious in their efforts with the "human machine," which, as has been pointed out, is equally essential.

Good Costing is Fundamental.

Regarding the actual production, a few remarks may be appropriate, though they will not cover the subject, by any means, and will be of a discursive character. The starting point in any effort to improve conditions is a good costing system, suited to place and product, which, while showing profit and loss figures, is so arranged that, from its details, information can be furnished for future comparisons and action. It should be the barometer of the foundry. Such figures as the total production, the number of hours worked, and the production in lbs. per man-hour or any other convenient period, should be readily available, along with various items of cost. These figures are extremely valuable for comparative purposes, and serve as a useful index to efficiency conditions in the foundry. Naturally, these figures must be considered with discrimination when making comparisons, as the class of work done month by month may vary considerably, and this must be taken into account. The costing should be done monthly, as it gives twelve opportunities in a year for comparing results and locating inefficient conditions, if they exist, as compared with only one in a yearly system. Though clearly note, a costing system, no matter how perfect, only records results; it does not produce castings.

The Handling of Orders.

The method of handling orders will vary with the size of foundry and class of work undertaken, but it must be so arranged that the progress of orders can be visualised, and that all particulars pertaining to it are available from one centre, without having to go from place to place to collect the information. How many are there who definitely plan their work ahead to meet delivery dates, arranging a full day's work for each of their moulders, and having the next day's work tabulated and set out, bearing in mind that no work is to be given out until everything the moulder requires is ready? Often, when a moulder requires a new job, one is selected from the number of patterns sent in and lying in the store or foundry. It is moulded and cast, not because it was actually required, but simply because it happened to be available. This is only, one might say, a half-truth, for want of a better word, because it is not desired to infer that foremen are negligent, and are not aware of certain urgent orders and repair work, which receives prompt attention, but rather to point out that much better results would be obtained in many directions if the work was definitely planned beforehand.

Tidiness makes Profits.

Moulders are employed to make moulds, but if many founders would analyse or make a time study of all the operations entering into the making of them, they would find a large portion of that time expended in preparing sand, hunting for gaggers, wedges, clamps, making up black wash, etc., etc., all of which should have been done by the less skilled worker, leaving the moulder free to make moulds only, for which purpose he was engaged. Arising from this is the question of the accessories. These are generally found lying about the floor and in odd corners. "A place for everything and everything in its place," is needed more in a foundry than in any other business, though it is a much more difficult problem than, say, in an engineering shop, due mainly to the nature and size of many of the accessories, but, if rigidly adhered to, would lead to economy in both time and space. Men should be encouraged to report delays of this nature, so that steps may be taken to effect a remedy. If moulding machines are installed, it must not be forgotten that this is only the first step, because efficient methods must be provided for supplying the machine with sand and boxes, and means for the quick removal of finished moulds. The machine, no matter how good, will not give efficient production unless the management, on its part, provides equal facilities.

The handling and transport facilities should receive close attention, particularly the loss of time due to waiting for cranes. A rearranging of the work, the erection of an air hoist, or even a chain pulley block may work wonders in overcoming this question of waiting. Under this heading comes the storage and handling of boxes, especially those in the open yard. Much can be done if some form of law and order is established. Generally these yards look much more like a scrap merchant's one than what they should be, an uncovered warehouse. Concrete paths both inside and outside the foundry when possible are a good investment, and in many cases a petrol-engine tractor with a few bogies, one of which should be of the tipping type, would very readily pay for its installation.

Sand Preparing and Handling.

The preparing and handling of sand has received much attention of late, but with many it still remains a vexed question, and one on which one cannot be too dogmatic. However, there are on the market excellent machines to meet the needs of every foundry, large and small, and no foundry can afford to be without one or more of these machines if they wish to progress on modern lines. A similar remark applies to the mixing of oil-sand for cores. Speaking of oil-sand, while this is now largely used, it is astonishing, as one moves about, to see the number that do not use it, or only in small quantities. While on the question of oil-sand cores, it is futile to expect to reap the full benefit from them if these are dried or baked in the old-fashioned mould- and core-drying stoves, where heat only is predominant, and no temperature control possible. Drying stoves in which only hot-air is admitted and under control as well as the temperature, are essential, though small cores can be and are baked efficiently in gas stoves of the drawer type.

Fettling Shop needs Modern Plant.

Finally, the dressing shop must come under review, *i.e.*, must be fully equipped with pneumatic chipping hammers, portable grinding machines, rumbling barrels having dust extraction, and efficient grinding machines. The fixed plant will naturally vary with the size of the foundry, and class of work undertaken, but sand-blasting plant should be adopted wherever conditions warrant it. A dust extraction plant, which couples grinders and rumblers, and in some cases cleaning benches, is also a step in the right direction, all of which are necessary in some degree, if it is desired to carry this efficiency campaign right up to the machine shop door.

In conclusion, it is felt that much has been left unsaid: for instance, there is the question of storage and the handling of material, a comprehensive subject in itself. There is also the equally important one, the melting equipment in its many varied forms, coupled with an efficient control. However, an attempt has been made roughly to outline the path that must be followed in the pursuit of efficiency.

No doubt it will be said that the target has certainly been set far enough away; if so, it means foundry executives have to improve their shooting and register as many "inners" as possible, at the same time striving to record "bull's eyes."

Conclusion.

Summing up the whole of this address, which can be done in a few words: Reduce all waste to a minimum, whether it be in material, time or energy, for waste in whatever form represents inefficiency. Therefore, let everybody, employer and employee, devote their energies to this purpose, and thus add their quota to the advancement of their country's prosperity, and that of their foundries in particular.

Vote of Thanks.

Mr. A. Lawrie (Past-President) said that he had listened with great pleasure to the address, which had set a very high ideal and which behoved all to learn not so much for talking as for thinking. There were many foundries which would go farther than they had, but the bad times precluded anything being done. He remembered an address given some years ago by Mr. McManus and Mr. Ross jointly, which impressed him very much, and this one has impressed him in even greater degree. It was evident that Mr. McManus was an authority on all that pertained to foundry efficiency. It was not usual, and he would not attempt, to discuss the Presidential Address, which was one to make them think seriously. He proposed that the best thanks be conveyed to the President for his address.

Mr. Campion said that he would like to second Mr. Lawrie's motion that the meeting express its thanks to the President for the excellent address which he had given them. He would like to refer to his mention of the human machine requiring some consideration as well as the mechanical machine. He was afraid that the human machine was too often ignored. The matter of personal efficiency was of great importance at the present time when they were up against foreign competition and low selling prices. Much of the success of foreign, and in particular German, firms was due to the personal efficiency of the workers, from the managing director to the youngest apprentice; everyone was a trained man and knew his job. Those firms carried no guinea pigs or deadheads: everyone was right on top of the job all the time. It was evident that the President had taken to heart what he had seen on Continental visits and had given them the benefit of his observations. He had mentioned the desirability

(*Concluded on page 258.*)

Notes on a Research on Faraday's "Steels and Alloys."

Before Section G.—Engineering of the British Association in London, on September 24, Sir Robert Hadfield, F.R.S., read a Paper on "Notes on a Research on Faraday's 'Steels and Alloys.'" We append a summary of the Paper:—

For the first time, the "Steel and Alloys" made by Michael Faraday during the period 1819-24 have now been subjected by the author to complete examination, including chemical analysis, metallographic, physical, mechanical and other tests. Hitherto, the only information available concerning Faraday's metallurgical researches has been that contained in Papers which he presented jointly with James Stodart, F.R.S., to the Royal Institution in 1820 and the Royal Society in 1822. Not much definite information from the modern point of view is to be gleaned from those Papers, as they contain very little in the way of chemical analyses or quantitative tests.

By kind permission of the Managers of the Royal Institution, the author has been able to investigate the nature and properties of 79 specimens of Faraday's steel and alloys by the aid of the resources of a modern research laboratory. From the information thus obtained, which could have been secured by no other means, it is evident that Faraday's work constituted an important and valuable research, specially considering the state of metallurgical knowledge and practice at the time. In fact, it was not only his first research, but also the first systematic research in the field of steel alloys on a comprehensive scale.

Faraday made and examined alloys of steel with at least sixteen different elements, as well as four special compounds, and, though the specimens examined by the author represent only a portion of the total number made by Faraday, it is clear that these prove his work by no means ended in failure, as has been stated by some who were not metallurgists and were only able to inspect the specimens, if, indeed, they saw them at all. Some of the most interesting alloys made by Faraday, including those containing very high percentages of platinum and rhodium, were not to be found in the small deal box, labelled "Steel and Alloys" in his own handwriting, which lay in the store-room of the Royal Institution for more than a century. A recent most careful search there failed to reveal any trace of these high platinum and rhodium alloys which Faraday described. Neither have the most painstaking inquiries in Sheffield and London brought to light any of the comparatively heavy ingots of Faraday's alloys, weighing 10 to 20 lbs. each, which were made to his instructions by the firm of Sandersons, in Sheffield.

All that has survived is the deal box, containing 79 specimens, of which only 13 weighed 100 grammes (3½ ozs.) or over, the heaviest 140.10 grammes (5 ozs.), and the other 66 averaged only 31 grammes (1.1 ozs.) each. The total weight of the 79 specimens was 7 lbs. 14 ozs. Information given in Stodart and Faraday's Papers of 1820 and 1822 provided some useful clues of a general nature, but there was nothing to indicate the actual composition of the individual specimens. Nevertheless, with so small a total weight of material, with so many alloys of different and quite unknown composition, and with the further handicap of having to work with a small portion of each specimen, so that none of these valuable relics might be completely destroyed, the author has succeeded in determining the composition, nature and properties of the greater portion of them, and from them he has discovered much information useful to-day.

In the Paper the author not only describes his own research on Faraday's specimens and presents the results obtained, but he also relates the circumstances which led up to Faraday's research, and describes the methods employed by that great experimental philosopher in this, the first, of his important researches. The author explains the important influence of wootz or Indian steel in the early years of last century, and makes clear the relation between James Stodart, the maker of surgical instruments and cutlery, and Michael Faraday, who at that time regarded himself primarily as a chemist. The primitive state of scientific and metallurgical knowledge in those days is indicated, and the hand-blown blast furnace and crucibles in which Faraday prepared his alloys are described. With these resources Faraday was able to melt pure iron, and to make alloys of platinum and steel. He could, in fact, reach such temperatures as often caused his best crucibles to soften and break down.

Educating Foundry Apprentices.

The members of the Middlesbrough Branch of the Institute of British Foundrymen combined business with pleasure when they held the first meeting of the 1931-32 session on October 9 at the Cleveland Scientific and Technical Institute, Middlesbrough.

After the Presidential Address by Mr. A. Gilbert Harrison, the members, with their ladies, engaged in a whist drive.

In his address Mr. Harrison, after welcoming the guests, expressed his gratitude to the members of the Branch for the honour which they had accorded him in electing him President for the ensuing year. He said that when the Middlesbrough Branch was formed in 1926, they had the honour of having the President, Mr. J. Cameron, J.P., at the meeting. During his remarks he said that one of the benefits he found in the Institute was that it made him take a much keener interest in his work. That statement he thought at the time was a little exaggerated; but now, after 5 years' attendance of meetings and works visits, he was convinced that Mr. Cameron was right, and, in fact, the interest became greater as time elapsed. This session he hoped to have the honour of a visit from the President, Mr. A. Harley, on February 26 next, and the Council trusted that members would note the date and show that what the Branch lacked in numbers it made up in enthusiasm.

Education of Foundry Apprentices.

It was an acknowledged fact, Mr. Harrison said, that in these days of mass production the old-time moulder was rapidly disappearing, and undoubtedly it caused great concern in the minds of those who had the interests of the industry at heart. Administrative posts would still have to be filled, and unless measures were taken, only semi-skilled men would be available. This could only be remedied by educating the present-day apprentices in both the practical and technical sides of foundry work. Members were no doubt aware that through the energies of the Middlesbrough Branch and of Dr. Ingall, foundry classes were established in Middlesbrough. Until 1929 only spasmodic attempts had been made to form classes, but now the Middlesbrough Education Authorities offered excellent facilities at the Constantine College. It was now for the foundry, both from the executive side and the apprentices, to see that the response was good.

The engineering classes were well attended, so why should the foundries lag behind now that the opportunity was offered? "Knowledge is power," and this adage was truer to-day than ever before The aim of educating foundry apprentices on the practical and technical side was to ensure a supply of skilled moulders capable of assuming posts of administration. Many of the managers and foremen on Tees-side deplored the fact that facilities as were now granted at the Constantine College were not available in their younger days. Many of them, and especially the local Junior Vice-President, took an active interest in the boys. This was all to the good, for the foreman then knew those who were trying, and, when any little job came into the shops different from the usual repetition work, it probably went to one of the students because he knew just a little more than his neighbour who spent his evenings in other ways. This was how his practical experience was gained, and, backed up by his technical knowledge, it enabled him to keep ahead of his neighbour. The slight technical knowledge acquired enabled him to understand and enjoy lectures such as were provided by the Institute and other technical associations, and also to read and understand technical literature on foundry work.

An author is often accused of being too technical and speaking above the heads of his audience, but this was not always so. It was exceedingly difficult to speak of, and understand, foundry problems without being technical. When foundry apprentices learnt both the practical and the technical side, then the majority of lectures would be doubly interesting to them. One might say that the little knowledge obtained by attending classes of instruction was only a means to an end; knowledge once accumulated, like the babbling brook, went on for ever, being an asset both to the youth himself and to the foundry industry.

Quite recently the Advisory Committee of the Institute, co-operating with the City and Guilds of London Institute, approved of a scheme of syllabuses for a grouped course of instruction in patternmaking in two stages, and also a three-year grouped course in foundry practice and science, at the end of which the student should be prepared to take the examination of the City and Guilds of London Institute. No doubt Mr. Foster, the foundry instructor of the Constantine College, would refer to this scheme in his Paper next January. The holding of the certificate granted by the City and Guilds would be well worth the labour entailed to obtain it, and in years to come a certificate of this description might perhaps be necessary for membership of the Institute.

Personal Efficiency in the Foundry.

(*Concluded from page* 257.)

of every foundry having a costing system suited to the work and place, and he was particularly interested to note the suggestion that production in lbs. per man-hour be included. It seemed to him that production was in many cases the solution of the problem and that greater attention should be paid to a man's production sheet rather than his pay sheet.

The President, in reply, thanked them for the vote of thanks and said that the title of his address was rather singular, but he chose it before the present crisis attacked them and it was singular that it should have so much bearing on it. They should all go through the foundry with their eyes open looking for waste in any shape or form and seeing what they could eliminate. It was wonderful what could be accomplished with perhaps a little organisation and with very little expense.

At the conclusion of the meeting the members and friends met at the Cadora Restaurant for a social evening. After tea, whist and music was enjoyed until a late hour.

Mrs. McManus presented the prizes to the winners. The President and Miss McGhie contributed several songs each, and Mr. H. Winterton acted as Master of Ceremonies.

Mr. H. D. Campbell proposed a vote of thanks to Mrs. McManus for presenting the prizes and to the President and Miss McGhie for the songs.

The President, in reply, said that they had come to the end of a happy day, which they might look upon as a happy event, and trusted that they had all enjoyed themselves and would all be there next year. He proposed a vote of thanks to Mr. Winterton for his services.

Hardness Induced by Nitriding.

In the course of a Paper entitled "An Appraisal of Nitriding," read by Mr. Marcus A. Grossmann at a meeting of the American Iron and Steel Institute, the author pointed out that, so far, there is as yet no clearly-established relationship between the iron-nitrogen equilibrium diagram and the structures and hardness obtained in nitriding. It is true that certain undesirable structures (*e.g.*, braunite) are obtained when certain temperatures are exceeded, and these temperatures correspond with lines in the iron-nitrogen diagram. But it is further true that properties which are helpful are also obtained under certain circumstances by heat treatments in the same ranges, as in the toughening treatment after nitriding. Furthermore, the temperature at which most nitriding is carried out, 510 deg. C., corresponds merely with a region of moderate solubility of nitrogen in iron. There is at present no correlation of heat-treatment with "critical points" in nitriding, as is well established in the iron-carbon equilibrium diagram.

A plausible mechanism of nitrogen hardening would seem to involve the following: a "splitting-off" of the nitrogen atoms from the ammonia at the surface of the metal, a diffusion of the nitrogen into the surface layers, still an atomic nitrogen, and an association of the nitrogen atoms with aluminium atoms in the steel to form stable and practically non-diffusible aluminium-nitrogen compounds, these aluminium-nitrogen compounds being the particles which impart to the iron its hardness (resistance to deformation).* The conception of manner of hardening is (in the absence of evidence) not discussed, except to say that whether it be lattice distortion or particle slip interference, an essential seems to be that the aluminium-nitride be in an extremely fine state of division. It seems reasonable to believe that the failure of unalloyed iron to acquire great hardness in nitriding, is due to the fact that the iron nitride agglomerates into relatively large masses (even as visible needles) which are presumably only moderately effective in hardening.

This agglomeration would seem, of course, to be associated with the greater diffusing of nitrogen when the iron is unalloyed, and is reflected in the greater depth to which nitrogen diffuses in plain iron, giving a greater "depth of case." Indeed, this phenomenon is practically universal in nitriding, the greater the thickness of case (in a given nitriding line) the less the surface hardness; and the author attributes this to the same fundamental condition. The aluminium atoms seem to form aluminium-nitride groupings, which are stable, hinder the bound nitrogen from diffusing further, and cause hardness in the iron lattice.

Now a higher temperature may be expected to cause more rapid diffusion, and there are certain data which support this hypothesis. It is known from the data of many observers that higher nitriding temperatures lead to lower hardnesses. Among several possible explanations is the assumption that there is more agglomeration of the aluminium nitride, leading to lesser effectiveness in hardening. That this explanation is highly probable appears from some data presented by Sergeson, who showed that a nitriding steel once hardened at an elevated temperature (650 deg. C.) with resulting lower hardness, will not become hard when renitrided at proper temperature (510 deg. C.); whereas adjacent to the previously-nitrided section, a fresh section in the same piece of steel will harden to full hardness.

It appears then, that when sufficient nitrogen has once been absorbed, the aluminium atoms become as it were saturated, or entirely bound by nitrogen atoms, so that they no longer have any capacity for binding further nitrogen atoms, or forming in association with them any hardness-giving particles. Further, it appears that once these aluminium-nitrogen groups have been formed within the steel, their power to diffuse becomes relatively very slight, as evidenced by the fact that steels hardened at 510 deg. C. can then be reheated to temperatures as high as 760 deg. C., or perhaps even 980 deg. C., without losing hardness (provided, of course, that they are protected from scaling or other surface effects). It should be emphasised that it is the temperature of first nitriding that is important, and this temperature is assured to be the vital factor in determining the particle size of the aluminium-nitrogen groups.

It might be expected that nitrogen compounds would be formed, especially at the surface, as happens in other cementation processes. It has, indeed, been shown by Harder and Todd that thin layers of compounds are found at the extreme surface of nitrided pieces, but their thickness is estimated to be only about 0.002 in. In the main, the nitrided case with full hardness showed only the alpha-iron pattern.

The author summarises his hypothesis by saying that it seems reasonable to attribute the hardness of "Nitralloy" to the presence of very finely-agglomerated aluminium-nitrogen compounds dispersed in the alpha iron.

* Aluminium is mentioned here as typical of the nitrogen hardening elements of which it is seemingly the most powerful. Other such elements include chromium, molybdenum, vanadium and others.

I.B.F. Elects New Members.

At a Council meeting of the Institute of British Foundrymen, held at the Royal Victoria Station Hotel, Sheffield, on October 17, the following were elected to the various grades of membership:—

As Subscribing Firm.

Beecroft & Partners, Limited, Retort Works, Mappin Street, Sheffield.

As Members.

C. Binks, foundry proprietor; T. Bryan, works representative, Harrison & Company, Limited, Lincoln; S. H. Butler, works superintendent, Linotype & Machinery, Limited; W. F. Chubb, B.Sc., metallurgist; W. G. Francis, managing director, Vulcan Patternmaking Company, Limited, Coventry; R. L. Hamilton, works manager, National Steel Foundry, Limited, Leven, Fife; F. N. James, mineral merchant, 120, London Road, Derby; P. M. Macnair, Ph.D., chief metallurgist, James Howden & Company, Limited, Westminster, London, S.W.1; J. Moyna, metallurgist and foundry manager, United Engineers, Singapore; A. J. Murphy, M.Sc., metallurgist, J. Stone & Company, Limited, Deptford, London, S.E.14; C. Thomson, pig-iron representative, Carron Company, Manchester; Dr.-Ing. Guido Vanzetti, secretary, Fonderia Milanese di Acciaio Vanzetti, Milan; W. Wallace, managing director, Rosebank Ironworks, Edinburgh; E. R. Walters, M.Sc., principal, Technical College, Lincoln; W. L. Woodcock, assistant works manager, W. Woodcock, Sons & Company, Limited, St. Helens; F. S. Wordsworth, metallurgist, Robert Hyde & Sons, Limited, Stoke-on-Trent; H. Wright, general manager, Kitson & Company, Limited, Leeds.

As Associate Members.

J. Callaghan, moulder, Stanton Ironworks Company, Limited, Nottingham; H. Callingham, patternshop foreman, Morris Motors, Limited, Coventry; W. J. Colton, metallurgist; A. B. Cooper, assistant foundry chemist, English Steel Corporation, Limited, Sheffield; C. J. Dadswell, Ph.D., B.Sc., assistant foundry manager, English Steel Corporation, Limited; F. A. Elsdon, moulder, W. H. Challingsworth, Limited, Birmingham; D. Fearnside, ironfounder, Samuel Fearnside & Sons, Keighley; J. Fearnside, moulder, Samuel Fearnside & Sons; W. O. Fernando, apprentice, Mechanical-Engineers' Department, Ceylon Government Railway; E. Flintham, brass-foundry foreman, Robey & Company, Limited, Lincoln; H. Foster, foundry teacher, Constantine Technical College, Middlesbrough; W. Head, patternmaker, Birmingham Foundries, Limited; A. G. Hobbs, moulder, South African Railways, Durban; R. J. Hooton, assistant foundry chemist, Staveley Coal & Iron Company, Limited, Chesterfield; D. Kermode, moulder, United States Metallic Packing Company, Limited, Bradford; H. F. Lawton, foundry engineer, Wilsons & Mathiesons, Limited, Armley, Leeds; E. H. Mees, assistant works metallurgist, Bailey, Pegg & Company, Limited, Brierley Hill; G. B. Morrison, cost clerk, Grangemouth Iron Company, Limited, Falkirk; W. Muir, brassfounder, David Muir & Sons, Bathgate, Glasgow; H. McNair, chemist, Smith & Wellstood, Limited, Bonnybridge; E. Noden, moulder, P. & C. Garnett, Limited, Cleckheaton; W. Parlane, iron moulder, Shotts Iron Company, Limited, Edinburgh; J. Pattison, assistant foundry metallurgist, Metropolitan-Vickers Electrical Company, Limited, Manchester; J. H. Pearce, assistant foundry chemist, English Steel Corporation, Limited; G. Wallace, iron moulder, Glenfield & Kennedy, Limited, Kilmarnock; A. V. Wright, estimator, Blairs, Limited, Govan.

As Associates.

A. B. Kent, works assistant, Sterling Manufacturing Company, Cubitt Town, London, E.14; J. McGrandle, laboratory assistant, British Cast Iron Research Association, Birmingham; W. Ralph, iron-pattern filler, Howard & Bullough, Limited, Accrington; P. H. Shotton, laboratory assistant, British Cast Iron Research Association; A. A. Timmins, assistant metallographist, British Cast Iron Research Association.

Catalogue Received.

Rolls and Iron Castings.—There is a fascinating mixture of the old and new in the binder for a new loose-leaf catalogue issued by Richard Nevill & Company, Limited, Wern Iron and Steel Works, Llanelly. It is composed of a particularly well-phrased modern message, surmounted by a mass of smallish printing and miniature pictures, which could have been used to better advantage elsewhere in the book.

The whole of the illustrations throughout the catalogue are captioned in French, German, Italian and Spanish, besides English, and confidence is given to the overseas buyer by the reproduction of a partial map of Europe, with lines drawn to the consumers from Llanelly. A valuable breakdown service is detailed on page 5, which operates 7 days a week for 24 hours.

A description of most of the departments—iron, steel and roll foundries, boileryard, annealing pit, patternshop and roll finishing—is given. The annealing pit referred to is for the tinplate industry, and its feature is that it is built up by suitably binding one large plate and welding it to form a box, with the additional factor that there are a number of vertical corrugations. As the function of this box is to transmit heat to its contents, be cooled down, then pursue the same heat cycle time after time, and do this without undue warping, it appeals to us as being capable of dimensional modification to render it eminently suitable for the malleable-castings industry. As the catalogue is available to our readers, we suggest that malleable founders procure a copy and form their own ideas on the subject.

Large Iron Casting.—A recent issue of "Iron and Steel of Canada" states that the Dominion Steel and Coal Corporation have made an iron casting at their foundry at Sydney, Nova Scotia, weighing about 55 tons. The casting is an octagonal ingot mould for steel, and is regarded as the largest casting ever made in Canada.

XUM

This Week's News in Brief.

Trade Talk.

The London offices of Messrs. Harland & Wolff, Limited, are now at 9, Whitehall, S.W.1.

The Cargo Fleet Iron Company, Limited, Middlesbrough, decided last week to relight another blast furnace.

Employees of William Beardmore & Company, Limited, Dalmuir, have contributed £338 to charities during the year.

Mr. Donald MacNicoll read a Paper on "Safety Valves" before the Institute of Marine Engineers on Tuesday, October 13.

Messrs. W. T. Henley's Telegraph Works Company, Limited, have established a new stores depôt at 31-33, Gwyn Street, Bedford.

The Worshipful Company of Goldsmiths have presented £1,000 to the Cambridge University for the better equipment of the Metallurgical Laboratory.

Messrs. Hughes, Bolckow & Company, Limited, Blyth, have bought for breaking-up purposes two White Star liners, the "Corinthic" and the "Demosthenes."

An order for a passenger and cargo steamer for Canadian owners has been booked by Messrs. Swan, Hunter & Wigham Richardson, Limited, Wallsend-on-Tyne.

The Blue Star liners "Roman Star" (5,715 gross tons) and "Tudor Star" (6,859 tons), which have been laid up in the Tyne for some months, have been sold to shipbreakers.

Hugh McLean & Sons, Limited, Govan, have received an order for 28 motor lifeboats for the new Cunard liner being constructed by John Brown & Company, Limited, Clydebank.

Messrs. Cox & Danks, Limited, have opened a new office in Birmingham, at Newton Chambers, Cannon Street. Mr. F. Rollinson, jun., from the firm's Manchester office, is the manager.

A repeat order for switchgear equipment for an electric sub-station in one of the Dominions has been placed with Messrs. A. Reyrolle & Company, Limited, Hebburn-on-Tyne. The order is valued at about £10,000.

The International Aluminium Cartel, which includes the chief producers in Great Britain, Germany, France, Norway, Austria and Switzerland, is to be dissolved at the end of this year, largely as a result of the rapid expansion of production in the United States.

The Board of Conciliation for the Regulation of Wages in the Scottish Pig-Iron Trade has received intimation that the average selling price for the quarter ended September 30 was £3 10s. 8d. There will be a consequent reduction of 1 per cent. in the wages of the workmen on basis rates.

In view of the prevailing business conditions, the Management Committee of the London Iron and Steel Exchange has decided that, until further notice, meetings will be held at the Cannon Street Hotel monthly on the second Tuesday in the month. Meetings, therefore, will be held this year on November 10 and December 8, at 3 p.m.

A publicity club has been formed in Sheffield, with Mr. A. K. Wilson, a former Master Cutler and leader of the Sheffield Industrial Mission to South America, as President. The steel, engineering and cutlery industries are well represented on the committee, and the honorary secretary is Mr. Arthur A. Black, Vernon House, Broomhall Road, Sheffield.

Mr. H. F. Gurney, H.M. Trade Commissioner in Newfoundland, is now in this country on an official visit. Mr. Gurney will be available at the offices of the Overseas Trade Department during the period October 19 to 23, to interview manufacturers and merchants interested in the export of British goods to Newfoundland and the Maritime Provinces.

According to "Steel" this month the Soviet Government has to make a total payment of about $15,000,000 on tractor, farm-implement and other orders placed with the International Harvester Company, the Oliver Farm Equipment Company, the Caterpillar Tractor Company, J. I. Case Company, Deere & Company, and the Massey-Harris Company.

The Nova Scotia Steel & Coal Company, Limited (a subsidiary of the Dominion Steel & Coal Corporation), has begun at its Trenton (Nova Scotia) plant one of the largest forging jobs yet undertaken there. The contract calls for three shaftings, each weighing 43 tons, which are required by the Canadian General Electric Company, Limited, for installation in a hydro-electric power plant.

H. Hendra & Son, ironfounders and pattern-makers, Townmead Road, Fulham, London, S.W.6, are constructing a new foundry at Beddington Lane, Croydon, to be known as the Townmead Iron Foundry. This will be of modern design, equipped with labour-aiding plant, and will include a pattern-shop of increased size. The whole of the firm's business will be transferred to this new foundry on December 1 next.

Changes with a view to reducing administrative expenditure are being carried out in Associated Electrical Industries, Limited. The office of managing director is being discontinued, and Sir Philip Nash is vacating that appointment, as also that of chairman of the board of Metropolitan-Vickers Electrical Company, Limited. Sir Philip Nash will remain on the board of Associated Electrical Industries, Limited.

The recently-formed Association of Secretaries of Engineering Societies in Glasgow have, in co-operation with the committees of the various societies participating, prepared a syllabus of meetings for the present session. The first part, covering meetings up to the end of the year, has just been published, and includes the arrangements of 18 societies. It is issued by the societies to their members, and its possession entitles them to attend any of the meetings included and to participate in the discussions.

Mr. Julian Piggott, manager of the British Steel Export Association, who is at present in Montreal, has announced there that a permanent sales organisation for Canada is to be established. Further efforts are to be made to extend in Canada the market for heavy steel beams and structural sections, and plates over 60 in. in width not rolled in the Dominion. Montreal will be the headquarters in Canada of the British Steel Export Association. Its offices will be in the Sun Life Building in Dominion Square. Mr. Piggott is returning to England at the end of this month.

The quarterly ascertained average net selling price of No. 3 Cleveland pig-iron entitles ironmasters, under the sliding-scale arrangements, to a reduction of 2 per cent. in North-East Coast blast-furnacemen's wages, which would lower wages to 1 per cent. below the base rate. The employers have agreed to a reduction of 1 per cent. only for the last quarter of the year. The certified net selling price for the three months ending September 30 last is 53s. 0.56d. per ton, as compared with 55s. 1.93d. for the previous quarter. Neither base rates nor bonus will carry any percentage for the present quarter.

Continuing their policy of co-ordinating the activities of their subsidiary companies, Agricultural & General Engineers, Limited, announce that, as from January 1 next, the manufacture of the products of their subsidiary company, E. H. Bentall & Company, Limited, will be transferred to the following A.G.E. subsidiary companies:—Bentall food-preparing machinery, Blackstone & Company, Limited, Stamford; Bentall coffee machinery, Richard Garrett & Sons, Limited, Leiston; Bentall valves, E. R. & F. Turner, Limited, Ipswich; and Bentall ploughs and other implements, James & Fredk. Howard, Limited, Bedford. This transfer completes the plan for co-ordinating the group's activities.

An interesting ceremony took place at Yarrow's shipbuilding yard on October 14, when the keels of two destroyers to be built for the Portuguese Government were laid by Madam Pereira da Silva, wife of Captain Pereira da Silva, of the Portuguese Naval Commission in this country. It is fifty years since Yarrow & Company, Limited, built their first vessel for the Portuguese Navy, and during this period they have built about 40 ships for the Portuguese fleet. Last week the company launched the "Dubrovnik," one of the largest and most powerful flotilla leaders ever constructed in this country. The vessel, built to the order of the Yugo-Slav Government, has a length of 371 ft., a beam of 35 ft., and armament composing of four 5.5-in. guns and an anti-aircraft gun. Her propelling machinery consists of geared turbines, supplied with steam from three latest-type Yarrow boilers, and she is designed for a speed of at least 37 knots.

Personal.

Regierungsrat i. R. Prof. Dr. Leidig, the Berlin manager of the German Foundry Employers' Federation, last week celebrated his 70th birthday.

Mr. H. Spence Thomas, managing director of the Melingriffith Company, Limited, sailed on October 10 for Brazil, where he intends to investigate the market for Welsh tinplates.

Mr. H. Toy, of Messrs. Toy & Company, engineers and founders, Helston, Cornwall, has accepted the invitation of the Town Council to serve as Mayor of the borough for another year.

By a resolution of the Council of the Institute of British Foundrymen, Mr. Andrew Harley, President of the Institute, now becomes President of the International Committee of Foundry Technical Associations.

Mr. Robert Elliot, late secretary of the Benevolent Committee of Colvilles' Dalzell Works, who has been transferred to the Clydebridge Works, has received presentations as a mark of appreciation of his ten years' service to the Committee.

Wills.

Nicholson, H., retired foundry manager, of Newburn £6,587

Horsfield, P. F., managing director of J. & J. Horsfield, Limited, engineers and ironfounders, Dewsbury £5,180

Bell, Sir Hugh, a director of Messrs. Dorman, Long & Company, Limited, Middlesbrough, and other companies £264,909

Holcroft, Harold, chairman and managing director of Messrs. Thomas Holcroft & Son, Limited, Ettingshall Foundry, Wolverhampton £21,961

Bishop, J. C., of Glasgow, a director of the Cadzow Coal Company, Limited, secretary of the Scottish Ironmasters' Association, the Scottish Manufactured Iron Trade Employers' Association, and the Scottish Steel Founders' Wages Association £24,636

Obituary.

Mr. Washington W. Balkwill, a native of England and a prominent figure in the American steel-foundry industry, died on October 4 at the age of 82 years. He founded the Cleveland Steel Casting Company in 1892, and was its president until 1913, when he retired. He was one of the organisers of the Steel Founders' Society of America.

Mr. Charles F. Hurst, managing director of Messrs. Samuel Russell & Company, Limited, malleable and grey-iron founders, of Walsall, died suddenly at Eastbourne on Wednesday, October 7. Mr. Hurst, who was 60 years of age, was President of the Walsall Chamber of Commerce for two years, and was made a Justice of the Peace in 1918.

Sir James McKechnie, formerly managing director of Messrs. Vickers, Limited, Barrow-in-Furness, died in London recently. Sir James spent part of his early career in Spain as manager of a naval construction yard. On returning to this country, he devoted himself to acquiring the technique of the naval construction work at Barrow, and was appointed after the outbreak of the war to control the naval construction works of Messrs. Vickers, Limited. Under his direction the works produced complete all classes of war vessels. He was also responsible to the Ministry of Munitions for the erection and management of the National Projectile Factory, Lancaster, and the National Filling Factory, Morecambe. He was made K.B.E. in 1918 for his war work.

Reports and Dividends.

Drake & Gorham, Limited.—Net profit, £8,242; brought in, £3,802; dividend of 5 per cent.; to general reserve, £1,250; written off debenture issue expenses, £1,250; carried forward, £3,294.

Murex, Limited.—Trading profit, £48,666; dividends and interest, &c., £34,207; loss on forward contracts for raw materials, £33,199; from general reserve, £16,600; final dividend of 20 per cent., making 35 per cent. for the year; carried forward, £28,908.

Tel. 22311 SHEFFIELD.

TO BRITISH STEELFOUNDERS

Gentlemen,

"National Politics—and Sand"

To-day, the line of action that a patriotic Britain ought to take in the interests of the Nation of which he is a part, has been so clearly and unmistakably defined by those best able to speak for the country, that it may be taken for granted that every reader who is a Steel Founder will wish to support the National Government and to dispense with Foreign Sands (both Silica and Moulding) as soon as ever he can.

For years and years we have ventured, on this page, to point out this duty—to-day our appeal is confirmed and emphasised by the Prime Minister himself, who says it is of the most vital importance that we "buy British."

The artificial cheapness of the franc has made import prices attractive, but British Quarrymen have "clammed" on the dole to keep them low, whilst, on the other hand, cheap continental steel castings have robbed British Steel Founders and their men of hundreds of thousands of pounds worth of work, embittered their lives and prevented their progress in every direction.

Now, we see what all this has led to, and those British Steel Founders who have been using imported sands and have for the first time realised the insecurity of the position that needless imports have created, have resolutely determined never again to send British money abroad to bolster up the finances of their competitors.

Faced with an advance in price of 20% to 25% they have made up their minds to spend their money in future, where it will have a chance to come back to them.

They will be glad to have an assurance that the whole of the industry can, if required, be supplied with "Yorkshire Sand" or "Silver Sand" from one or other of our six plants in various parts of the country, that we have no intention of increasing prices, that we are willing to meet all competition in both price and quality, and that we are anxious to contract till the end of 1932.

May we have a line from those interested, with a view to arranging a visit from our Representative?

Yours faithfully,

GENERAL REFRACTORIES LTD.

P.S.—Remember that "Silax" and "Plasstick" are British Cupola Linings.

Raw Material Markets.

There have been signs during the past week of a falling-off in the demand for pig-iron. Such a development was only to be expected, in view of the recent heavy purchases made by the foundries, which have, in some cases, covered their requirements to the end of the year. The export situation is showing some improvement, additional sales for shipment having been made. It cannot yet be said that any pronounced improvement in the position of the consuming works has taken place, and it is on this factor that the pig-iron market depends for a maintenance of the stronger position recently established.

Pig-Iron.

MIDDLESBROUGH.—Sales of Cleveland pig-iron to home consumers have slackened slightly, owing to the large amount of forward buying that has taken place recently, in order to forestall any rise in prices. The latter step seems not unlikely, as makers' stocks have now been considerably reduced, while there has been no noticeable increase in the rate of production. It is true that an additional furnace has been blown in at the Cargo Fleet ironworks, but the iron produced will not go on the market, as it is required for the local steelworks. On the other hand, the producers are disturbed at the fact that there has been no appreciable alteration in the position of the foundries, which, in view of their recent heavy purchases and their present low rate of consumption, will not need to purchase any more raw material for some time. Prices are unchanged. No. 1 Cleveland foundry iron is at 61s. per ton, No. 3 Cleveland G.M.B. at 58s. 6d., No. 4 foundry at 57s. 6d., and No. 4 forge at 57s. per ton.

The East Coast hematite market is in a much stronger position. Makers' stocks have been decreased considerably, and several important forward contracts have been fixed with British works. There has also been an improvement in the export position, and a good number of sales for shipment have been recorded, mostly to Italy and Denmark. There are no fixed quotations, higher prices being generally asked for forward delivery. East Coast mixed numbers can be bought at between 65s. and 66s. per ton, with 6d. premium for No. 1.

LANCASHIRE.—As was expected, there has been a falling-off in the demand for pig-iron in the Lancashire market, the foundries having been, in the last week or so, fairly active buyers on forward account. The position now centres upon the possibility of an improvement in the consumption of the foundries, the majority of which are in want of work. There has been no change in prices, although a firmer tendency is in evidence. For delivery to users in the Manchester price zone, Staffordshire, Derbyshire and North-East Coast brands of No. 3 iron are quoted at 67s. per ton, with Northamptonshire foundry iron at 65s. 6d., Derbyshire forge at 62s., Scottish No. 3 at about 87s. and West Coast hematite iron at about 81s. per ton.

MIDLANDS.—There has been a reaction in the demand for pig-iron in this area, the majority of the foundries being now well supplied with raw material, and little new business is passing. There has been a slight improvement in consumption, chiefly in the light-castings industry, but little material alteration in the general position. For delivery to Birmingham and Black Country stations, makers maintain the price of 62s. 6d. for Northants No. 3 and 66s. for Derbyshire, North Staffordshire and Lincolnshire No. 3.

SCOTLAND.—A meeting of the Scottish pig-iron producers was held last week, and it was decided to make no alteration in prices. Hence Scottish No. 3 foundry remains at 69s. 6d., while Cleveland iron is maintained at the increased price of 62s. 6d. per ton f.o.t. Grangemouth. Continental iron is, for all practical purposes, off the market.

Coke.

In Northumberland and Durham the demand for foundry coke has eased off slightly, but makers are already fully supplied with orders until the end of the year. Beehive foundry cokes are especially difficult to secure. In the Middlesbrough area prices are on the up-grade, and already 17s. 6d. has been paid for best Durham furnace coke. In the Midlands there has been no increase in the price of foundry coke, but a rise is considered inevitable, and consumers are covering themselves for the next few months.

Steel.

The majority of the finished-steel works are in want of orders, and at present are only kept running on small jobs. There has been an increase in the price of small steel bars, for which the home makers are receiving more orders. In the semis market fewer orders are going abroad, owing to the difficulty of transacting business. The British mills are much busier, and prices have been increased.

Scrap.

The Cleveland market is much stronger, but there has not been sufficient buying to warrant a big advance in prices. Heavy cast iron is quoted at 42s. 6d. while light castings are stronger at 32s. The demand for scrap on the Midlands market is much stronger, although prices have not yet advanced. Heavy machinery cast-iron scrap remains at 47s. 6d., and light cast iron at 37s. 6d. The South Wales market has, as yet, failed to expand. On the Scottish market sellers are more optimistic, and prices are tending upwards. Best machinery scrap, in pieces not exceeding 1 cwt., is now at 51s. to 52s. 6d. per ton, with ordinary cast iron, to the same specification, about 5s. less.

Metals.

Copper.—Interest in the copper market is mainly centred on the probable outcome of the producers' conference. The position in the United States, as revealed by the September statistics, is serious. The total stocks have increased by some 26,000 tons, and a further cut in production seems necessary, perhaps to the extent of a 25 per cent. all-round reduction. Meanwhile, there seems no hope of any early improvement in the domestic consumption of the U.S.A. Copper Exporters, Inc., maintain their price of 7.50 cents c.i.f. Europe. The price of copper in the home market is maintained at a steady level. There has been a moderate demand for electro, but business has slackened somewhat pending the result of the General Election. What business is offering is mostly taken by non-combine firms.

Closing quotations :—

Cash.—Thursday, £34 17s. 6d. to £35; Friday, £34 16s. 3d. to £34 17s. 6d.; Monday, £35 11s. 3d. to £35 12s. 6d.; Tuesday, £35 13s. 9d. to £35 16s. 3d.; Wednesday, £35 12s. 6d. to £35 15s.

Three Months.—Thursday, £35 12s. 6d. to £35 15s.; Friday, £35 12s. 6d. to £35 13s. 9d.; Monday, £36 6s. 3d. to £36 8s. 9d.; Tuesday, £36 6s. 3d. to £36 7s. 6d.; Wednesday, £36 7s. 6d. to £36 10s.

Tin.—On this side of the Atlantic there has been quite a good demand for tin, mostly for near delivery. Consumption in England seems to be improving, in view of the better position of the motor-car trade and the Welsh tinplate industry. In America, on the other hand, consumers are taking very little interest in the market, and the position remains very difficult.

Official closing prices :—

Cash.—Thursday, £131 to £131 5s.; Friday, £130 17s. 6d. to £131 2s. 6d.; Monday, £128 7s. 6d. to £128 10s.; Tuesday, £127 2s. 6d. to £127 5s.; Wednesday, £127 15s. to £127 12s. 6d.

Three Months. — Thursday, £133 5s. to £133 7s. 6d.; Friday, £133 to £133 5s.; Monday, £130 15s. to £131; Tuesday, £129 10s. to £129 12s. 6d.; Wednesday, £130 2s. 6d. to £130 5s.

Spelter.—The market is somewhat steadier and will continue so, provided there are no exaggerated fluctuations in sterling. There is a good demand at present prices, and sellers are inclined to hold, in anticipation of a rise.

Daily fluctuations :—

Ordinary. — Thursday, £12 10s.; Friday, £12 8s. 9d.; Monday, £13; Tuesday, £13; Wednesday, £13 2s. 6d.

Lead.—This metal is in the most favourable position, and buying has been on a satisfactory level during the past few weeks. At the same time, there are large supplies ready to meet any sudden demand.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £13 5s.; Friday, £13 3s. 9d.; Monday, £13 5s.; Tuesday, £13 6s. 3d.; Wednesday, £13 7s. 6d.

Tungsten in China.

According to a U.S. Commerce Report, general conditions in Kiangsi were greatly disturbed throughout the second quarter of 1931. The National Government and the provincial government have not yet come to any working agreement as to who is in control of the Kiangsi mines. The monopoly granted by Kiangsi is still in the hands of a private company, whose name has been changed to the Kiangsi Ho Chun Wolfram Trading Company (Limited), with agreement unchanged from that formerly established with the provincial government.

The average monthly production was 350 long tons of tungsten in Kiangsi during the quarter. The Hunan ore is mined by small concerns and the monthly production is very small, estimated to average about 75 tons. Accurate information as to available stocks of tungsten ore is difficult to obtain, but it appears that about 300 tons were at Kiangsi mines at the end of June, with practically negligible supplies at the Hunan mines and at Changsha. Stocks at Hankow were depleted to 10 tons at the end of the quarter.

During June 100 tons of tungsten ore were shipped from Kiukiang, the first shipment in several months. The greater part of the Kiangsi production goes through Canton and Hong Kong. During the quarter 111 tons were shipped from Changsha, 35 tons going to Hankow. The Hankow market for tungsten ore experienced an almost steady decline from the high price of the first quarter, and local business has not been good.

Contracts Open.

Alnwick, October 24.—222 yds. of 2-in. cast-iron socket pipes, for the Rural District Council. The Clerk, 28, Bondgate Within, Alnwick.

Crickhowell, November 5.—Cast-iron pipes, for the Rural District Council. The Council Offices, Beaufort Chambers, Crickhowell. (Fee £2, returnable.)

Johannesburg, October 31.—Pumping plant, for the city of Johannesburg. The Department of Overseas Trade. (Reference G.X. 10,804.)

Johannesburg, October 31.—Sewage pumping plant, for the city of Johannesburg, involving two centrifugal pumps and electric motors. The Department of Overseas Trade. (Reference G.X. 10,798.)

London (Kempton Park), November 16.—Two steam turbines with centrifugal pumps, generator, and electrical booster pump, for the Metropolitan Water Board. The Offices of the Board, Chief Engineer's Department (Room 173), 173, Rosebery Avenue, E.C.1. (Fee £3 3s., returnable.)

Wellington N.Z., January 26, 1932.—25-ton overhead travelling double-girder crane, for the New Zealand Public Works Department. The Department of Overseas Trade. (Reference A.X. 11,132.)

New Companies.

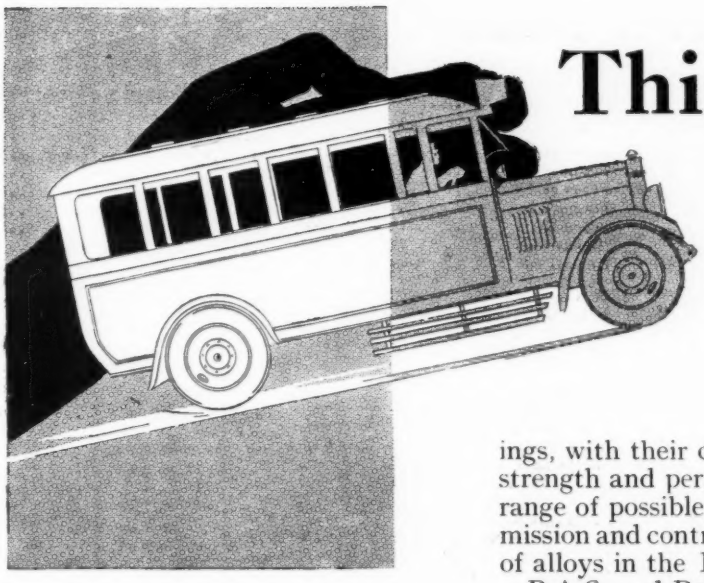
District Iron & Steel Company (1931), Limited.—Capital £100. Directors: F. L. Broughton, Park House, Warwick; H. A. Keen and J. Payton.

Wardlows, Limited.—Capital £1,500. Steel and iron forgings manufacturers, etc. Directors: C. Wardlow, 11, Endcliffe Hall Avenue, Sheffield, and W. Collins.

A. C. Potter & Company, Limited, Dysart Road Ironworks, Dysart Road, Grantham.—Capital £60,000. Waterworks and general engineers, etc. Directors: A. C. Potter and P. J. Nicholls.

Aluminium & Chromium Coatings, Limited.—Capital £10,600. Directors: S. R. Sheppard, F. A. Rissik and A. J. L. Ball. Solicitors: Bristows, Cooke & Carpmael, 1, Copthall Buildings, London, E.C.

At the Manchester College of Technology, on October 3, besides the presentation of 142 students for the Associateship of the College, Honorary Associateships were conferred upon Lord Eustace Percy, President of the Royal Institution and ex-President of the Board of Education, and upon Mr. K. Baumann, who is a director and chief mechanical engineer of the Metropolitan-Vickers Electrical Company, Limited.



This problem simply met!

Surplus weight, with killing drag upon costs and performance, is the first enemy of the road vehicle operator. Hence the appeal of aluminum alloy castings, with their combination of lightness, strength and permanence. For the whole range of possible castings in engine, transmission and controls, there is ample variety of alloys in the British Aluminium series —B.A.C. and British Standard alloys.

Some aluminium castings for commercial cars

Cylinder Block
Cylinder Head
Exhaust Manifold
Crank Case
Piston and Connecting Rods
Carburettor
Radiator Casing and Tanks
Gear Box
Axle Casing
Brake Drums
Brake Shoes
Hub Caps
Fan
Sump
Inlet Manifold
Clutch Housing
Differential Casing
Steering Column

Write for the complete B.A.C. alloys data.

Light Alloys of Aluminium

THE BRITISH ALUMINIUM CO., LTD.
ALUMINIUM PRODUCERS, ADELAIDE HOUSE, LONDON, EC4
Telephones: MANSION HOUSE 5561 and 8074 (5 lines). Telegrams: "CROYLITE, BILGATE, LONDON."

F.T.J. 22-10-31.

COLVILLES LIMITED.
195 WEST GEORGE STREET, GLASGOW. C.2.
TELEPHONE 9280 CENTRAL
TELEGRAMS "COLVILLETT" GLASGOW.

COLVILLE STEEL DALZELL

Colville's for Steel of Special Qualities

STEEL
STRENGTH SECURITY

LONDON OFFICE
6 SPRING GARDENS,
COCKSPUR STREET, S.W.1.

ALL SIZES
ALL SHAPES

DUCOL STEEL
HIGH TENSILE STEEL
HIGH ELASTIC LIMIT STEEL
WEATHER RESISTING STEEL
ANTI-CORROSIVE STEEL
FREE CUTTING STEEL
STAINLESS IRON

CAST IRON FLANGED PIPES
2 in.–12 in. & CONNECTIONS. to 24 in. dia.
WE HAVE FIFTY-TWO YEARS OF ACCUMULATED EXPERIENCE AND METAL PATTERNS.
JAMES & RONALD RITCHIE, LTD.,
Telephone: 3852 (2 Lines). MIDDLESBROUGH. Telegrams: "Ritchie, Middlesbrough."

WEEKLY PRICE CURRENT.

COPPER.

	£ s. d.
Standard cash	35 12 6
Three months	36 7 6
Electrolytic	40 10 0
Tough	37 0 0
Best selected	37 10 0
Sheets	75 0 0
India	48 10 0
Wire bars	41 10 0
Do., November	41 10 0
Do., December	41 10 0
Ingot bars	41 10 0
H.C. wire rods	44 10 0
Off. av. cash, Sept.	31 11 1 3/4
Do., 3 mths., Sept.	32 9 1 1/4
Do., Sttlmnt., Sept.	31 11 1 7/16
Do., Electro, Sept.	36 12 1 10/16
Do., B.S., Sept.	33 10 10
Do., wire bars, Sept.	37 1 4 1/4
Solid drawn tubes	10½d.
Brazed tubes	10½d.
Wire	7½d.

BRASS.

Solid drawn tubes	9½d.
Brazed tubes	11½d.
Rods, drawn	8½d.
Rods, extd. or rlld.	5½d.
Sheets to 10 w.g.	8½d.
Wire	8½d.
Rolled metal	7½d.
Yellow metal rods	5½d.
Do. 4 × 4 Squares	6d.
Do. 4 × 3 Sheets	6d.

TIN.

	£ s. d.
Standard cash	127 15 0
Three months	130 2 6
English	129 5 0
Bars	131 5 0
Straits	131 12 6
Australian	129 12 6
Eastern	132 12 6
Banca (nom.)	142 12 6
Off. av. cash, Sept.	117 17 10 1/16
Do., 3 mths., Sept.	120 15 8 1/2
Do., Sttlmt., Sept.	117 17 6

SPELTER.

	£ s. d.
Ordinary	13 2 6
Remelted	12 5 0
Hard	9 10 0
Electro 99.9	15 5 0
English	13 12 6
India	11 15 0
Zinc dust	23 0 0
Zinc ashes	3 15 0
Off. aver., Sept.	11 16 4 1/4
Aver. spot, Sept.	11 11 5 1/16

LEAD.

	£ s. d.
Soft foreign ppt.	13 7 6
English	14 15 0
Off. average, Sept.	11 19 6 13/16
Average spot, Sept.	11 18 7 7/16

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	24 0 0
Do., V.M. ex-whf.	24 10 0
Rods	30 0 0
Boiler plates	—
Battery plates	—

ANTIMONY.

	£ s. d.
Special brand, Eng.	40 0 0
Chinese	25 10 0
Crude	20 10 0

QUICKSILVER.

Quicksilver (nom.) .. $80

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	8 0 0
45/50%	10 17 6
75%	15 17 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% c. free	4/2 lb. Mo. plus 25%
Ferro-titanium—	
23/25% carbon-free	10d. lb.
Ferro-phosphorus, 20/25%	£16 0 0 to 17 10 0
Ferro-tungsten—	
80/85%	1/8½ lb. plus 20%
Tungsten metal powder—	
98/99%	1/11½ lb. plus 20%
Ferro-chrome—	
2/4% car.	£34 0 0
4/6% car.	£25 5 0
6/8% car.	£24 0 0
8/10% car.	£22 10 0
Ferro-chrome—	
Max. 2% car.	£35 10 0
Max. 1% car.	£39 0 0
Max. 0·70% car.	£41 0 0
70% carbon-free	11d. lb.
Nickel—99%	£215 0 0 to £220 0 0
Ferro-cobalt	8/6 lb.
Aluminium 98/99%	£95 0 0
Metallic chromium—	
96/98%	3/- lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £ 9 0 0
Metallic manganese—	
94/96% carbon-free	1/6 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 3/32 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

South Wales—	£ s. d.	£ s. d.
Heavy steel	2 2 6 to	2 5 0
Bundled steel and shrngs.	1 16 0 to	2 2 0
Mixed iron and steel		1 15 0
Heavy cast iron		2 5 0
Good machinery for foundries		2 10 0
Cleveland—		
Heavy steel		1 17 6
Steel turnings		1 5 0
Cast-iron borings		1 2 0
Heavy forge		2 7 6
W.I. piling scrap		2 0 0
Cast-iron scrap	2 2 6 to	2 5 0
Midlands—		
Light cast-iron scrap		1 17 6
Heavy wrought		2 5 0
Steel turnings, f.o.r.		0 17 0
Scotland—		
Heavy steel		1 18 6
Ordinary cast iron		2 6 0
Engineers' turnings		1 6 0
Cast-iron borings		1 10 0
Wrought-iron piling		2 2 6
Heavy machinery		2 11 0

London—Merchants' buying prices delivered yard.

Copper (clean)	28 0 0
Brass	20 0 0
Lead (less usual draft)	11 0 0
Tea lead	8 0 0
Zinc	6 0 0
New aluminium cuttings	60 0 0
Braziery copper	26 0 0
Gunmetal	24 0 0
Hollow pewter	82 0 0
Shaped black pewter	60 0 0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	61/-
Foundry No. 3	58/6
Foundry No. 4	57/6
Forge No. 4	57/-
Hematite No. 1	65/6
Hematite M/Nos.	65/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	74/6
„ d/d Birm.	84/6
Malleable iron d/d Birm.	117/6
Midlands—	
Staffs common*	—
„ No. 4 forge*	61/-
„ No. 3 fdry.*	66/-
Shrops basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	57/6
„ fdry. No. 3*	62/6
„ fdry. No. 1*	65/6
Derbyshire forge*	61/-
„ fdry. No. 3*	66/-
„ fdry. No. 1*	69/-
„ basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	72/-
„ No. 3	69/6
Hem. M/Nos. d/d	68/6
Sheffield (d/d district)—	
Derby forge	58/6
„ fdry. No. 3	63/6
Lincs forge	—
„ fdry. No. 3	63/6
E.C. hematite	79/-
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby forge	62/-
„ fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	87/-
Clyde, No. 3	87/-
Monkland, No. 3	87/-
Summerlee, No. 3	87/-
Eglinton, No. 3	87/-
Gartsherrie, No. 3	87/-
Shotts, No. 3	87/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.)	9 15 0 to	10 5 0
Nut and bolt iron	8 5 0 to	8 10 0
Hoops		—
Marked bars (Staffs) f.o.t.		12 0 0
Gas strip		—
Bolts and nuts, ¾ in. × 4 in.		—
Steel—		
Plates, ship, etc.	8 15 0 to	8 17 6
Boiler plts.	8 15 0 to	9 15 0
Chequer plts.		10 7 6
Angles		8 7 6
Tees		9 7 6
Joists		8 15 0
Rounds and squares, 3 in. to 5½ in.		9 7 6
Rounds under 3 in. to ¾ in. (Untested)	6 17 6 & up.	
Flats—8 in. wide and over		8 12 6
„ under 8 in. and over 5 in.		8 17 6
Rails, heavy	8 5 0 to	8 10 0
Fishplates		12 0 0
Hoops (Staffs)		—
Black sheets, 24g.	8 5 0 to	9 0 0
Galv. cor. shts.	9 15 0 to	10 0 0
Galv. flat sheets	10 5 0 to	10 10 0
Galv. fencing wire, 8g. plain		—
Billets, soft	5 5 0 to	5 10 0
Billets, hard		6 12 6
Sheet bars	5 0 0 to	5 10 0
Tin bars		5 0 0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	11½d.
Sheet to 10 w.g.	12½d.
Wire	12½d.
Rods	12½d.
Tubes	1/7d.
Castings	12½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
3/- to 10 g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	16.26
No. 2 foundry, Valley	17.00
No. 2 foundry, Birm.	12.00
Basic	17.26
Bessemer	18.76
Malleable	18.76
Grey forge	18.26
Ferro-mang. 80%	85.00
O.-h. rails, h'y, at mill	43.00
Billets	29.00
Sheet bars	29.00
Wire rods	35.00
	Cents.
Iron bars, Phila.	2.09
Steel bars	1.60
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.60
Skelp, sheared steel	1.60
Steel hoops	1.80
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	2.90
Wire nails	1.90
Plain wire	2.20
Barbed wire, galv.	2.55
Tinplates, 100-lb. box	$4.75

COKE (at ovens).

Welsh foundry	22/6 to 25/-
„ furnace	14/- to 15/-
Durham and Northumberland—	
„ foundry	14/6 to 15/6
„ furnace	14/6 to 15/-
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes 20×14 per box	14/- to 14/6
„ 28×20 „	28/- to 29/-
„ 20×10 „	20/6
„ 18¾×14 „	15/-
C.W. 20×14 „	13/-
„ 28×20 „	—
„ 20×10 „	—
„ 18¾×14 „	—

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6 0 0 to £7 0 0
Bars, hammered, basis	£16 10 0 to £17 0 0
Bars and nail-rods, rolled, basis	£15 17 6 to £16 5 0
Blooms	£10 0 0 to £12 0 0
Keg steel	£32 0 0 to £33 0 0
Faggot steel	£18 0 0 to £23 0 0
Bars and rods dead soft, st'l	£10 0 0 to £12 0 0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

TUBES AND FITTINGS.

Current Discounts.

	Tubes.	*Fittings.*
Gas	62½%	57½%
Water ..	58½%	52½%
Steam ..	55%	47½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
Oct.	15 ..	34	17	6	dec.	12/6
,,	16 ..	34	16	3	,,	1/3
,,	19 ..	35	11	3	inc.	15/-
,,	20 ..	35	13	9	,,	2/6
,,	21 ..	35	12	6	dec.	1/3

Electrolytic Copper.

		£	s.	d.		
Oct.	15 ..	41	10	0	No change	
,,	16 ..	40	10	0	dec.	20/-
,,	19 ..	40	10	0	No change	
,,	20 ..	40	10	0	,,	,,
,,	21 ..	40	10	0	,,	,,

Standard Tin (cash).

		£	s.	d.		
Oct.	15 ..	131	0	0	inc.	5/-
,,	16 ..	130	17	6	dec.	2/6
,,	19 ..	128	7	6	,,	50/-
,,	20 ..	127	2	6	,,	25/-
,,	21 ..	127	15	0	inc.	12/6

Tin (English ingots).

		£	s.	d.		
Oct.	15 ..	132	10	0	inc.	5/-
,,	16 ..	132	10	0	No change	
,,	19 ..	130	0	0	dec.	50/-
,,	20 ..	128	15	0	,,	25/-
,,	21 ..	129	5	0	inc.	10/-

Zinc Sheets (English).

		£	s.	d.		
Oct.	15 ..	23	0	0	No	change
,,	16 ..	23	0	0	,,	,,
,,	19 ..	23	0	0	,,	,,
,,	20 ..	24	0	0	inc.	20/-
,,	21 ..	24	0	0	No	change

Spelter (ordinary).

		£	s.	d.		
Oct.	15 ..	12	10	0	dec.	6 5
,,	16 ..	12	8	9	,,	1/3
,,	19 ..	13	0	0	inc.	11/3
,,	20 ..	13	0	0	No change	
,,	21 ..	13	2	6	inc.	2/6

Lead (English).

		£	s.	d.		
Oct.	15 ..	14	15	0	dec.	5/-
,,	16 ..	14	15	0	No change	
,,	19 ..	14	15	0	,,	,,
,,	20 ..	14	15	0	,,	,,
,,	21 ..	14	15	0	,,	,,

AVERAGE MONTHLY PRICES OF MARKED BARS (SOUTH STAFFS).

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1897	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0
1898	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	8 0 0	8 0 0	7 11 8
1899	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 10 0	9 0 0	9 0 0	9 10 0	10 0 0	10 0 0	10 0 0	8 3 4
1900	11 0 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 5 10
1901	9 10 0	9 10 0	9 10 0	9 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 16 8
1902	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 7 6
1903	8 5 0	8 5 0	8 5 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 8 9
1904	8 10 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 10
1905	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 10 0	8 10 0	8 1 8
1906	8 10 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	8 10 0	8 10 0	8 10 0	8 10 0	9 0 0	8 15 10
1907	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0
1908	9 0 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 5 10
1909	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0
1910	8 0 0	8 0 0	8 0 0	8 0 9	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0
1911	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0
1912	8 10 0	8 10 0	8 10 0	8 15 0	9 0 0	9 0 0	9 0 0	9 8 0	9 10 0	9 10 0	9 10 0	9 15 0	9 1 6
1913	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	9 10 0	9 10 0	9 4 0	9 0 0	9 0 0	9 13 8
1914	8 12 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	8 14 4
1915	9 0 0	9 0 0	9 3 0	10 2 0	10 15 0	11 10 0	12 0 0	12 0 0	12 0 0	12 7 6	12 10 0	13 10 0	11 5 0
1916	13 10 0	13 10 0	14 13 0	15 0 0	15 0 0	15 0 0	15 0 0	15 10 0	15 10 0	15 0 0	15 10 0	15 0 0	14 18 7
1917	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0	15 10 0
1918	15 12 6	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	16 0 0	17 0 0	17 0 0	16 6 3
1919	18 0 0	18 10 0	20 0 0	20 0 0	23 0 0	23 0 0	23 0 0	24 12 0	25 0 0	25 0 0	25 0 0	25 5 0	22 10 7
1920	26 17 6	27 0 0	28 0 0	30 5 0	30 10 0	33 10 0	33 10 0	33 10 0	33 10 0	33 10 0	33 10 0	33 10 0	31 10 2
1921	31 10 0	30 3 4	27 10 0	27 10 0	27 10 0	24 15 0	21 0 0	20 0 0	20 0 0	17 10 0	17 0 0	16 0 0	23 7 4
1922	16 0 0	14 17 6	14 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 18 1½
1923	13 10 0	13 10 0	13 16 0	14 7 6	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 5 3½
1924	14 10 0	14 10 0	14 10 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	14 17 6	14 17 3½
1925	15 0 0	15 0 0	15 0 0	15 0 0	15 0 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	14 0 0	14 13 4
1926	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	14 0 0	*	14 10 0	14 0 10
1927	14 10 0	14 10 0	14 10 0	14 10 0	14 10 0	13 10 0	13 10 0	13 10 0	13 10 0	13 0 0	13 0 0	12 18 0	13 15 8
1928	12 10 0	12 10 0	12 10 0	12 2 6	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 2 8½
1929	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	12 7 6	12 10 0	12 10 0	12 2 3½
1930	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 10 0	12 15 0
1931	12 10 0	12 10 0	12 10 0	12 8 0	12 0 0	12 0 0	12 0 0	12 0 0	12 0 0	—	—	—	—

* No quotation available.

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG

IRON

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

19, ST. VINCENT PLACE, GLASGOW.

ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS WANTED.

FOUNDRY FOREMAN (Non-ferrous) seeks position; 17 years' practical experience art, architectural, and all branches of commercial cast work; first-class refs.—Apply, Box 908, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY Foreman seeks engagement, aluminium and non-ferrous metals; 22 years' experience motor and engineering trades; full knowledge of moulding machines and plates for mass production; London district preferred.—Box 912, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

MOULDER, age 27, single, desires post; experience includes Diesel, turbine, steam engines, chemical, etc., iron and non-ferrous; willing to go anywhere.—Box 916, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of The Foundry Trade Journal.

Any Member, Associate Member or Associate of the Institute of British Foundrymen who desires his qualifications to be inserted in the column must forward to the General Secretary of the Institute the following information:—(a) Name and address; (b) name of present employer (or last employer if unemployed); (c) brief particulars of qualifications, experience, and type of position required. The name will not be disclosed until the candidate is in communication with a prospective employer. Announcements will be inserted in two successive issues, unless announcers' requirements have been met with in the meantime.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

The Institute of British Foundrymen and the Proprietors of The Foundry Trade Journal wish it to be clearly understood that they accept no legal responsibility in connection with this service, for which no charge is made to members of the I.B.F.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester.

METAL Patternmaker requires situation. Accustomed to modern plate patterns for large and small ferrous and non-ferrous castings. Textile and motor experience. (148)

PRACTICAL Foundry Manager, with first-class experience in Loam, Dry and Green Sand, Iron and Brass, desires position. Varied experience at home and abroad. Sound technical training. (149)

PROPERTY.

BRASS FOUNDRY, old-established, for Sale; well located and equipped; splendid opportunity for one or two men; plant, metals, etc., with goodwill, about £600; genuine.—Write, Box 914, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PROPERTY—*Continued.*

MAGNIFICENT

11 ACRES WORKS SITE.

SHEFFIELD.

145,000 Sq. Ft. of Shops.

SIDING CONNECTIONS

with L.M. & S. and L. & N.E. Rlys.

WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

BRISTOL.

TO Engineers, Founders, Manufacturers.—Fine site of nearly three acres on arterial road, with Foundry and Workshops and own Rail Sidings into the premises. Modern Offices, Warehouses and Workrooms. Central Heating. —Charles A. Tricks & Son, Auctioneers, St. Nicholas Street, Bristol.

PUBLICATION

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. A new edition will be published next January. Secure your advertising space now. Rates on application.—Industrial Newspapers, Ltd., 49, Wellington Street, Strand, London, W.C.2. Telephone: Temple Bar 3951 (5 lines).

MACHINERY.

WANTED, Furnace, Morgan Type "S" 600 lbs., coke-fired. Must be in good condition. State price and where to be seen.—Write or 'phone, Morris-Singer Company, 123, Dorset Road, South Lambeth. 'Phone No.: Reliance 2821.

SAND MIXERS.—New and Secondhand. Ask us to quote.—W. Brealey & Company, Limited, Station Works, Ecclesfield, Sheffield.

THOS. W. WARD, LTD.

12-in. x 48-in. CINCINNATI No. 3 Universal Grinder.

10-in. x 24-in. Universal Precision Reamer Backing-off Grinder.

12-in. x 24-in. No. 3 "Ohio" CINCINNATI Universal and Tool Grinder, with magnetic chuck.

One 20-ton STEAM BREAKDOWN CRANE, 25-ft. swan-neck jib; 23 ft. maximum radius; 4-ft. 8½-in. gauge; 80 lbs. w.p.; runner on three pairs of wheels.

(ASK FOR "ALBION" MACHINERY CATALOGUE.)

ALBION WORKS, SHEFFIELD.

MISCELLANEOUS.

GANISTER, best quality for cupolas, also for Steel Works.—Astbury Silica Company, "The Brooms," Park Lane, Congleton.

RYLAND'S DIRECTORY

[2,200 pages 8½" × 5½"].

The standard work of reference covering the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades.

Write for advertisement rates now. A new edition will be published in January. Closing for press shortly.

INDUSTRIAL NEWSPAPERS, Ltd.
49, Wellington St., Strand, London, W.C.2.
Telephone: Temple Bar 3951 (5 lines).

'Phone: 287 SLOUGH

SELECTIONS FROM STOCK

Four adaptable moulding m/cs	each	£12
3 ft. 6 in. "Evans" Sandmill		£15
4 ft. 6 in. "Evans" Sandmill	...	£20
"Jackman" Rotary Sifter	...	£8
"Herbert" sand whizzer	...	£32
"Jackman" sand whizzer	...	£12
No. 0 "Jackman" Cupola	...	£32
Two "NORTON" D.E. fettling grinders	each	£14

BUY FROM ME AND SAVE MONEY!

ALEX. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH

Bradley's

REFINED

PIG IRONS

give consistently high tensile and transverse tests and possess all those inherent properties which go to make sound, strong and perfect castings.

Full particulars of the Bradley Mixture Service are contained in an interesting booklet, a copy of which will be sent free on request.

BRADLEY & FOSTER LIMITED
DARLASTON, STAFFS

Telephone: Darlaston 16 (P.B. Ex.) Telegrams: "Bradley, Darlaston."

PETER—WITH ONE EXCEPTION

With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun, and on occasions—be it admitted—of naughtiness. Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice-Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception. Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

Would you like to know more about him? How, in spite of his "One Exception," he is being educated and, when older, technically trained and usefully employed. There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.

Here's a suggestion. Your eyesight is worth 3d. a year to you. Send Peter and his handicapped pals 3d. for every year you've had it. Now, please, in case it slips your memory. Good idea?

The Chairman,

SCHOOL FOR THE BLIND
(Founded 1838)
SWISS COTTAGE, LONDON, N.W. 3